# GEOPHYSICAL SURVEYS FOR GROUND WATER EVALUATION CENTRAL AQUIFER AND WEST BEACH AREAS OAHU, HAWAII

# GEOPHYSICAL SURVEYS FOR GROUND WATER EVALUATION CENTRAL AQUIFER AND WEST BEACH AREAS OAHU, HAWAII

**Prepared For:**

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April 10, 1990

(Our Project #90006)

## Table of Contents

## 1.0 INTRODUCTION

A time domain electromagnetic (TDEM) geophysical survey was conducted from March 13 to March 21, 1990, on the Island of Oahu, Hawaii, by Blackhawk Geosciences, Inc. (BGI) for Ewa Plains Water Development Corporation (EPWDC). The survey was performed to assist in the evaluation of the hydrogeologic section in two areas

- Northwest of Waipahu (Central Aquifer area)
- Northwest of Honokai Hale (West Beach area).

The objectives of the geophysical survey in the Central Aquifer area were:

1. To map the depth, location, and continuity of impermeable layers that may have formed at the unconformity between the Waianae and Koolau lava flows.
2. To map the depth of the fresh - salt water interface on either side of the Waianae-Koolau unconformity.

The objective of the geophysical survey in the West Beach area was to map the depth to the fresh-salt water interface.

## 2.0 LOGISTICS AND DATA ACQUISITION

The TDEM survey was accomplished by a four man crew consisting of two BGI personnel and two local temporary field helpers. The location of the geophysical survey lines and soundings were determined during consultation with EPWDC and their consultants. Initially, TDEM soundings were made along a east-west line near the existing wells east of Honouliuli Gulch. These measurements were made near the 400 ft elevation for correlation with well data. The survey lines and loop locations of the TDEM soundings for the Central Aquifer and West Beach areas are shown on Figures 2-1 and 2-2, respectively. Sounding locations were surveyed using a compass and hip-chain from known road junctions located on the field map.

During the nine days of field work a total of 24 soundings were acquired over the two areas. A daily log of field activities is given in Table 2-1.

In the Central Aquifer area, often two measurements were made at each location to resolve both the shallow thin unconformity, as well as the deep saline water interface. This was accomplished by using large (up to 1,500 ft by 1,500 ft) transmitter loops on 13 of the soundings, and smaller (400 ft to 600 ft) transmitter loops on 7 of the soundings. Loop sizes varied according to coverage needed on survey lines and available property and road access.

In the West Beach area four soundings were taken with transmitter loop sizes of 400 ft by 400 ft.

After the third day of the TDEM survey in the Central Aquifer area, access restrictions were placed upon the field crew by the landowner. These restrictions were as follows:

1. TDEM data could not be taken east of Kunia Road due to young sugar cane growth.

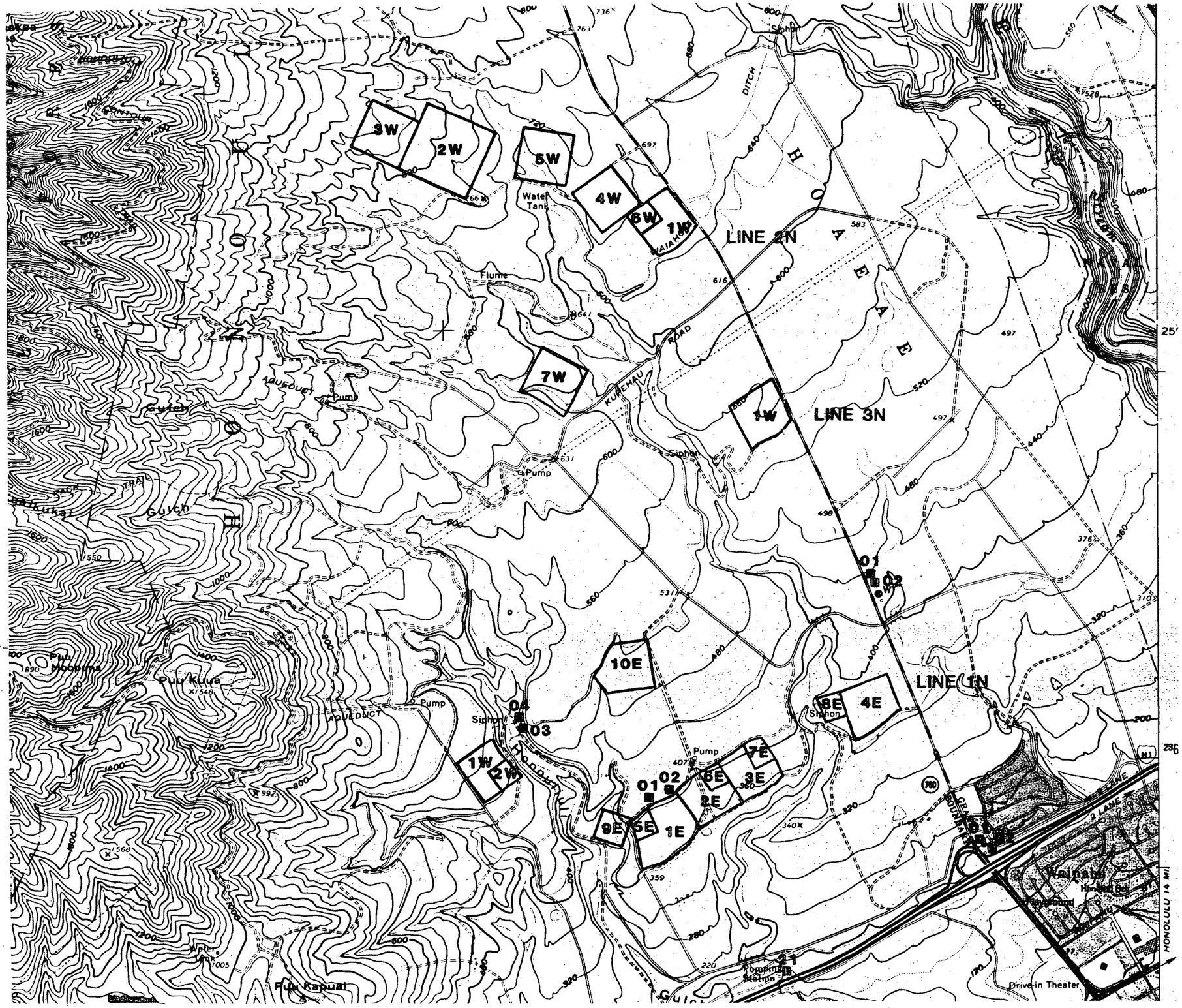
2. TDEM data taken south of Line 2N could only be acquired in open (fallow fields) or after 3:30 p.m. when sugar cane employees had completed their work day.

3. The TDEM crew could not work later than 4:30 p.m. in the sugar cane fields for security reasons.

Because of these restrictions, productivity and optimum station density were somewhat limited.

The Geonics EM-37 TDEM system was utilized on this survey. This system records the decay of the vertical magnetic field through a receiver coil placed at the center of the non-grounded

transmitter loop. Receiver coils with effective areas of 100 $m^2$ and 1,000 $m^2$ were utilized at base frequencies of 3 Hz and 30 Hz. During data acquisition numerous transient decays are collected with the receiver for each sounding. Readings were acquired at several receiver gains with opposite receiver polarities for each sounding location. The readings were stored in a DAS-54 solid state data logger, which were nightly transferred to a Compaq computer for processing.




## LEGEND

1W ☐ Sounding Loop Location

01 ■ Well Locations and Number (2303-01)

2000 0 2000

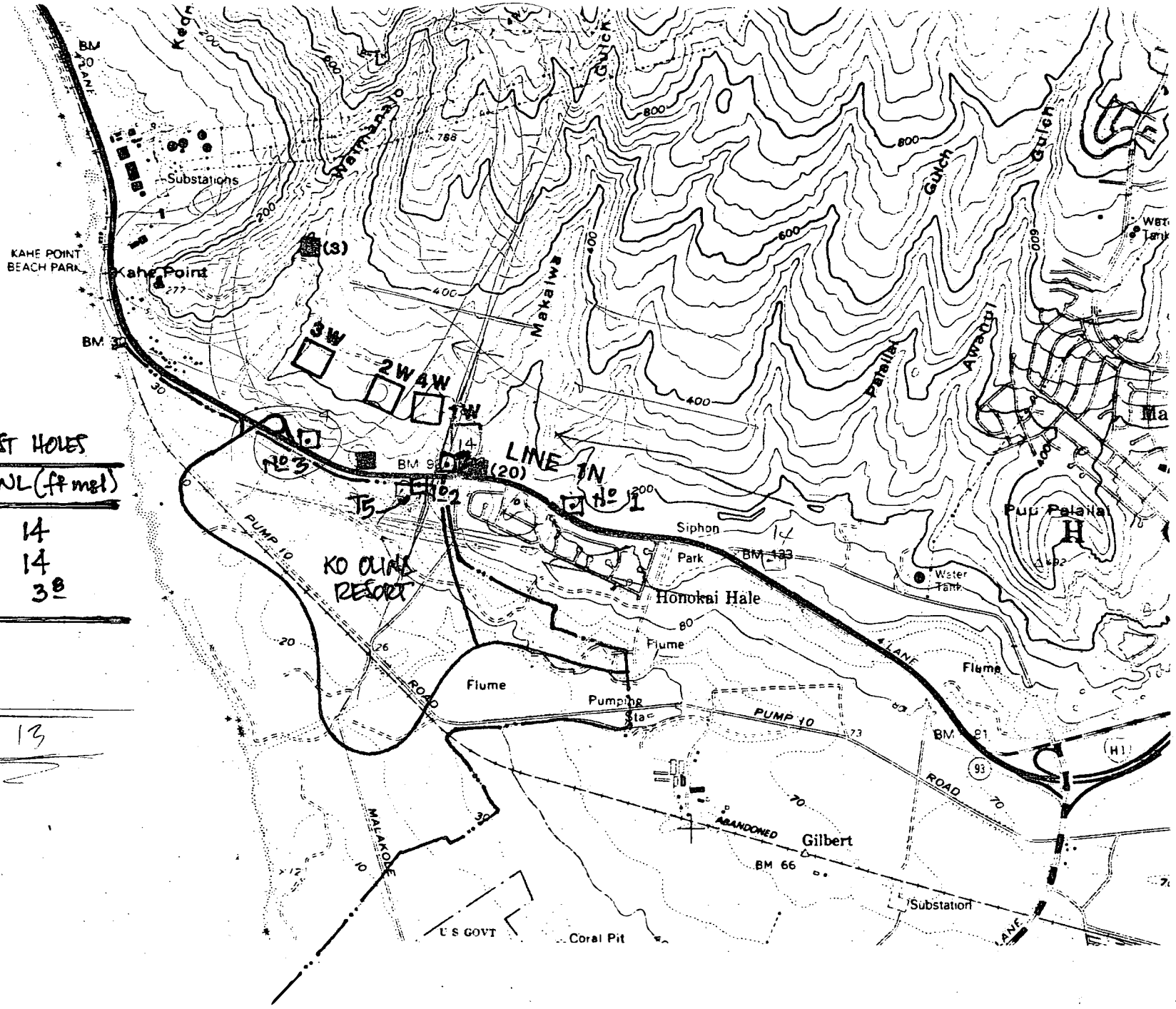
SCALE - FEET

**BLACKHAWK GEOSCIENCES, INC.**

GEOPHYSICAL SURVEY
LOCATION MAP

*Ewa Plains Water Dev. Corp.*
*Central Aquifer Oahu, HI*

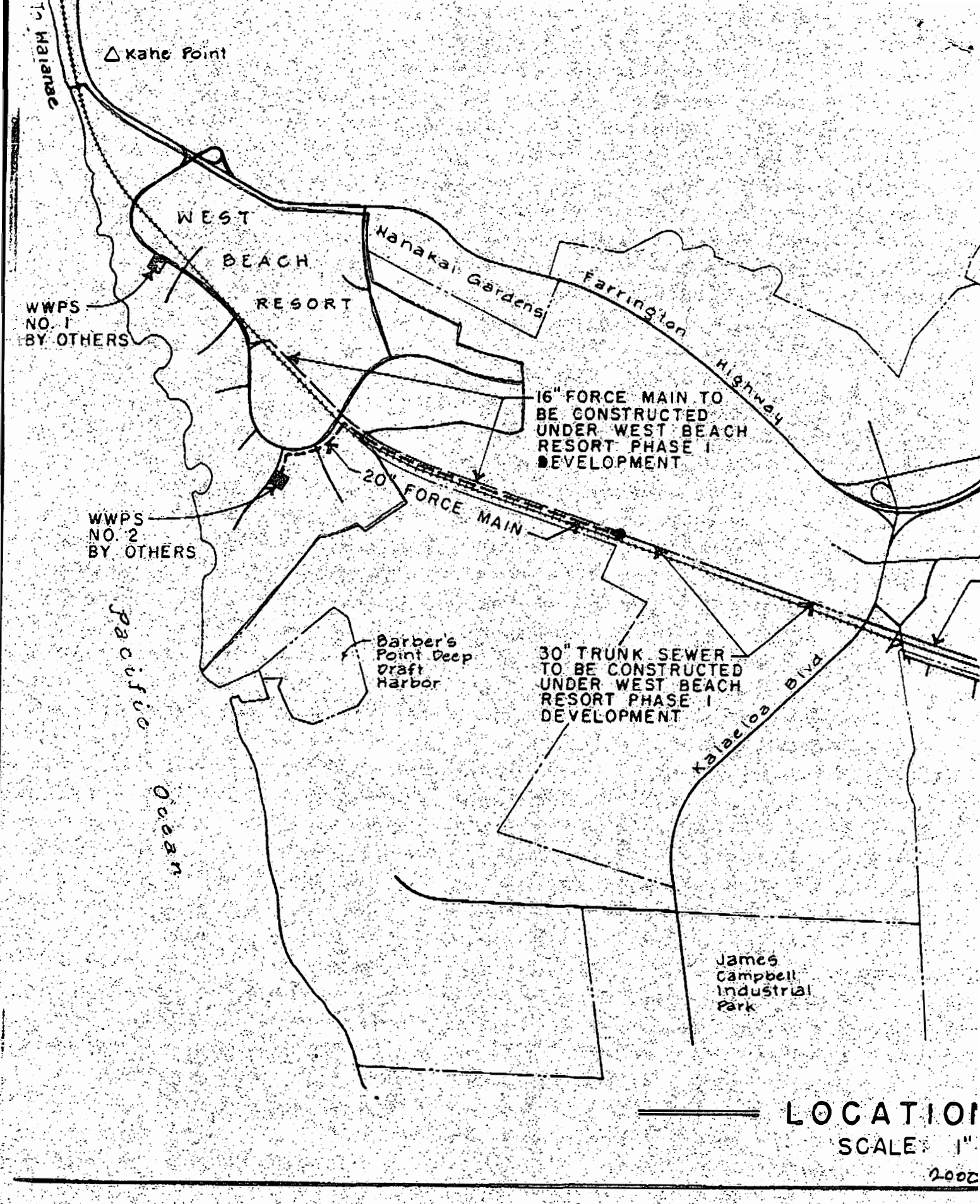
PROJECT NO.: 90006 FIGURE 2-1




MAKAIWA TEST HOLES

| No | SWL (ft msl) |
|---|---|
| 1 | 14 |
| 2 | 14 |
| 3 | 3± |

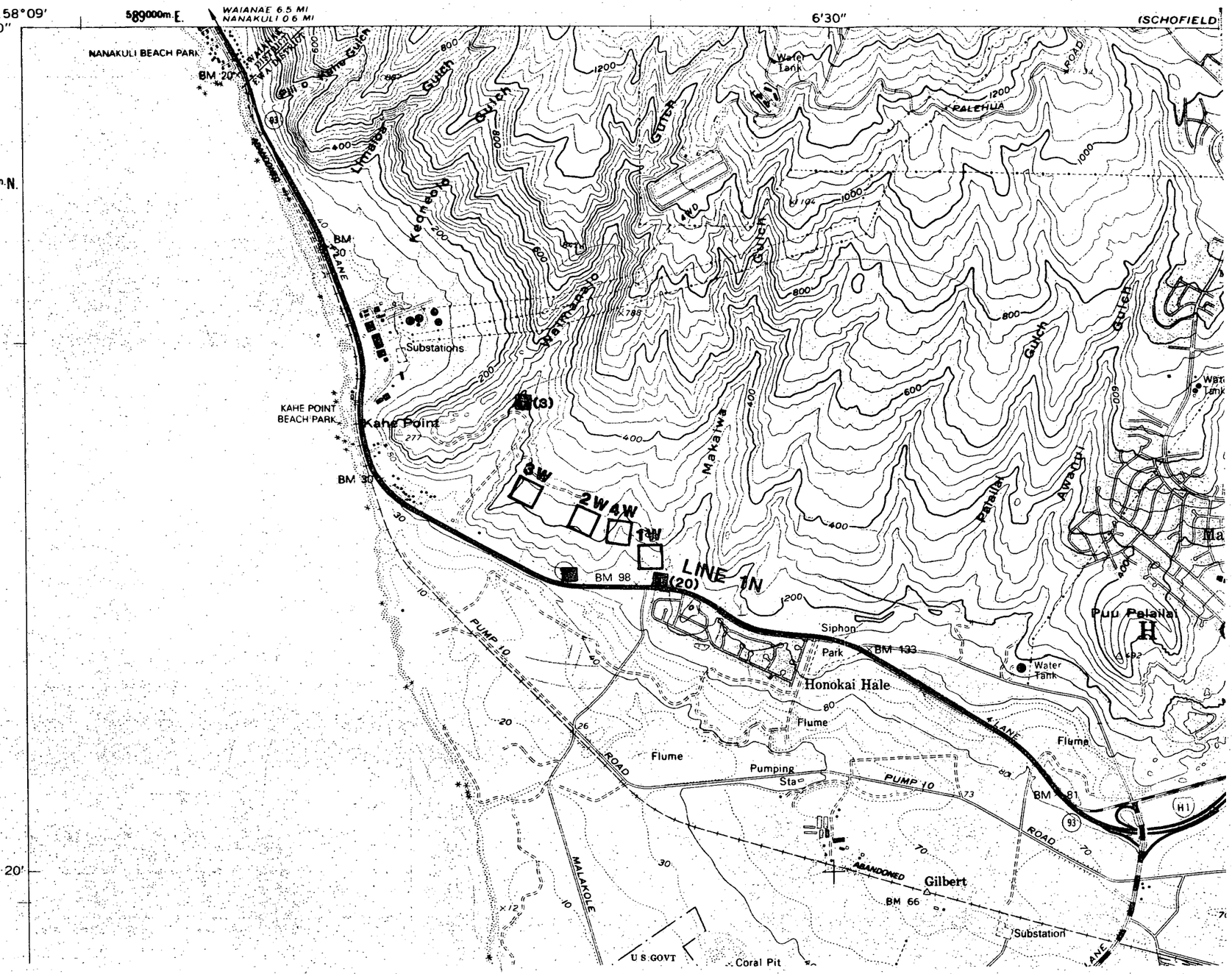
87 | 13




LOCATION

SCALE: 1"

2002




## LEGEND

- 1W — Sounding Loop Location
- Well Locations
- (3) — Hydrostatic Head (feet)

2000 0 2000

SCALE - FEET

**BLACKHAWK GEOSCIENCES, INC.**

GEOPHYSICAL SURVEY
LOCATION MAP
*Ewa Plains Water Dev. Corp.*
*West Beach, Oahu, HI*

**PROJECT NO.: 90006** FIGURE 2-2

**Table 2-1. Daily log of field activities**

| Date (1990) | Activity |
|---|---|
| March 11 | Mobilization from Denver, CO to Honolulu, HI. |
| March 12 | Meeting with personnel from Campbell Estates and finish mobilization. |
| March 13 | Meeting in A.M. with Oahu Sugar then begin work in Central Aquifer area. Soundings 1N1E and 1N2E. |
| March 14 | Soundings 1N3N, 1N4E and 1N1W in Central Aquifer. |
| March 15 | Soundings 1N5E, 1N6E in Central Aquifer. Asked by Oahu Sugar to stop work. Move to West Beach Area. Sounding 1W. |
| March 16 | Meeting in A.M. at Oahu Sugar. Discussed work restrictions in Sugar Cane Fields. Soundings 2W and 3W and West Beach Area. Meeting in afternoon with Del Monte. |
| March 17 | Central Aquifer soundings 1N6E, 1N7E, 1N8E and 1N10E. |
| March 18 | Central Aquifer soundings 2N1W, 2N2W and 2N3W. |
| March 19 | Central Aquifer soundings 2N4W, 2N5W and 2N6W. |
| March 20 | West Beach Area sounding 4W and Central Aquifer sounding 2N7W. |
| March 21 | Central Aquifer soundings 1N9E and 3N1W. |
| March 22 | Demobilize equipment and personnel. |

## 3.0 DATA PROCESSING

The field data acquired each day was transferred from the DAS-54 data logger to a Compaq computer. The data for each sounding location is edited and combined (both 3Hz and 30 Hz frequencies) to produce a transient decay curve. This decay curve is transformed into an apparent resistivity curve, which is entered into an Automatic Ridge Regression Transient Inversion Program (ARRTI). From the apparent resistivity curve a one-dimensional model of resistivities and thicknesses is calculated.

The inversion program requires an initial estimate of the geoelectric section, including the number of layers, and the resistivities and thicknesses of each of the layers. The program then adjusts these parameters so that the model curve converges to best fit the curve formed by the field data set. The inversion program does not change the total number of layers within the model, but allows all other parameters to float freely.

In general, field data quality throughout the survey site was excellent, although several soundings (2N1W, 2N7W and 3N1W) near major power lines were effected by excessive 60-cycle noise.

The apparent resistivity curves and data sheets for all soundings are contained in Attachment A.

# 4.0 INTERPRETATION RESULTS

## 4.1 GENERAL

The results of the interpretation of individual soundings is the resistivity layering as a function of depth. Where soundings are acquired reasonably close together then results of individual soundings can be plotted to form a geoelectric section along a line. Two geoelectric sections were constructed from soundings in the Central Aquifer area, and one geoelectric section was made from soundings in the West Beach area.

To infer from the geoelectric sections geologic and geohydrologic information, characteristic ranges of resistivities are assigned to known local geologic and geohydrologic units. The assigned resistivity ranges for the various units encountered in the survey area are shown in Figure 4-1. An overlap occurs between the resistivity ranges. The most extensive overlap occurs between the clay soils or weathered volcanics and the dry unweathered or fresh-brackish water saturated volcanics. Since thick clay soils or weathered volcanics occur mainly at the surface, these two units can often be separated by their depth of occurrence in the section. The resistivity of the layer at the unconformity appears to fall in the same range as the clay soils and weathered volcanics.

In general, it is difficult to distinguish between fresh water saturated volcanics and brackish water (< 500 ppm chlorides) saturated volcanics by resistivity interpretation. The reasons for this are that in addition to salinity, changes in lithology and porosity also influence formation resistivity.

In both survey areas the lower boundary of the fresh - brackish water lens was interpreted to be terminated by the basal salt water interface rather than impermeable rock. From the interpreted depth to the salt water interface the amount of head and thickness of the fresh - brackish water lens can be calculated using the Ghyben-Herzberg Principle. This principle states that for every foot of fresh water above sea level there will be about forty feet of fresh water below sea level. An illustration of the Ghyben-Herzberg Principle is given in Figure 4-2.

## 4.2 GEOELECTRIC CROSS-SECTIONS/CENTRAL AQUIFER AREA

Line 1 North

The geoelectric section for Line 1N is shown in Figure 4-3. In the geoelectric section the unconformity between the Koolau and Waianae lava flows was detected in soundings 1N9E, 1N1E, 1N2E and 1N3E. From the geoelectric section an apparent dip for the

unconformity of approximately 50° towards the east is derived. At sounding 1N1W the uppermost layer is also interpreted as the unconformity, rather than surficial soils, because it is thicker than would be expected for soils, and it correlates with the apparent dip of the unconformity derived from soundings east of Honouliuli Gulch. At sounding 1N4E the conductive layer at -520 ft depth is undetermined, because it coincides with the depth of salt water.

The depth to salt water saturated volcanics varies between elevation -520 ft at 1N4E to about -785 ft at 1N9E. The elevation of the fresh-brackish water head derived from the Ghyben-Herzberg relationship is also shown on the figure. The upward undulation of the salt water interface interpreted at soundings 1N1E and 1N2E and the low resistivity of the volcanics below the unconformity could possibly be caused by upconing of salts due to pumping of the wells.

Wells in Honouliuli Gulch and near soundings 1N1E and 1N2E (Fig. 2-1) encountered water at static heads of 17 ft (personal communication with Tom Nance, 04/90). The head calculated for soundings in the vicinity of these wells ranges from 14.7 ft to 19.8 ft. This difference between head calculated from TDEM soundings and that measured in the boreholes is within interpretational error limits.

A comparison of the TDEM sounding results from sounding 1N1E and the geologic log from well 2303-01 is given in Figure 4-4. The results of the TDEM soundings are given in two formats on the left, (i) as a depth-resistivity log, and (ii) in terms of geohydrologic units using the classification shown on Figure 4-1. On the right side of the figure the condensed geologic log from well 2303-1 is shown. Good correlation between the TDEM interpretation and major geologic units is observed. The unconformity from the geologic log is found between 379 and 485 ft in depth. In the TDEM interpretation the unconformity and zone of increased weathering above the unconformity have been interpreted as one conductive layer with a resistivity of 20 ohm-m and a thickness of about 225 ft.

Line 2 North

The results of the geoelectric cross-section for Line 2N are shown in Figure 4-5. The sounding locations are shown in Figure 2-1. All soundings show a thick upper (≈ 125 ft to > 300 ft) conductive zone interpreted as soils and/or weathered volcanics. Along this section the layer at the unconformity between the Waianae and Koolau lava flows was not detected, except possibly at 2N1W. The soundings show the fresh-saline interface to be deeper on the west side of the section with a distinct rise towards the eastern side. Sounding 2N1W shows a conductive layer

(15 ohm-m) at a depth of approximately 520 ft (about 150 ft above sea level). This layer is interpreted as a zone of weathered volcanics or possibly a layer at the unconformity. This sounding was taken near the Kunia Road where several power lines are located which may have distorted the decay curve at later measuring time gates. Additional soundings on the east side of Kunia Road would help to confirm the extent of this layer.

Contour Map

In the Central Aquifer area TDEM data are mainly concentrated along two profiles, because the TDEM crew was denied access to most of the area between the two profiles.

In order to incorporate the soundings located between the two profiles (1N10E, 3N1W, 3N7W) into one data set a contour map of the results of all of the soundings in the Central Aquifer area was constructed (Fig. 4-6). In this figure the elevation of the top of the salt water interface derived from the TDEM measurements is contoured. These values are approximately equal to the thickness of the fresh-brackish water lens. Also shown on this figure are the values for hydrostatic head calculated from the depth to saline water using the Ghyben-Herzberg Principle. In addition to the TDEM data, water level information from two wells along the H-1 freeway was also incorporated into the contour map (information furnished by Nance, 1990, personal communication).

Two main features are evident in the contour map. These are:

1. The decreasing hydrostatic head towards the area near sounding 3N1W.

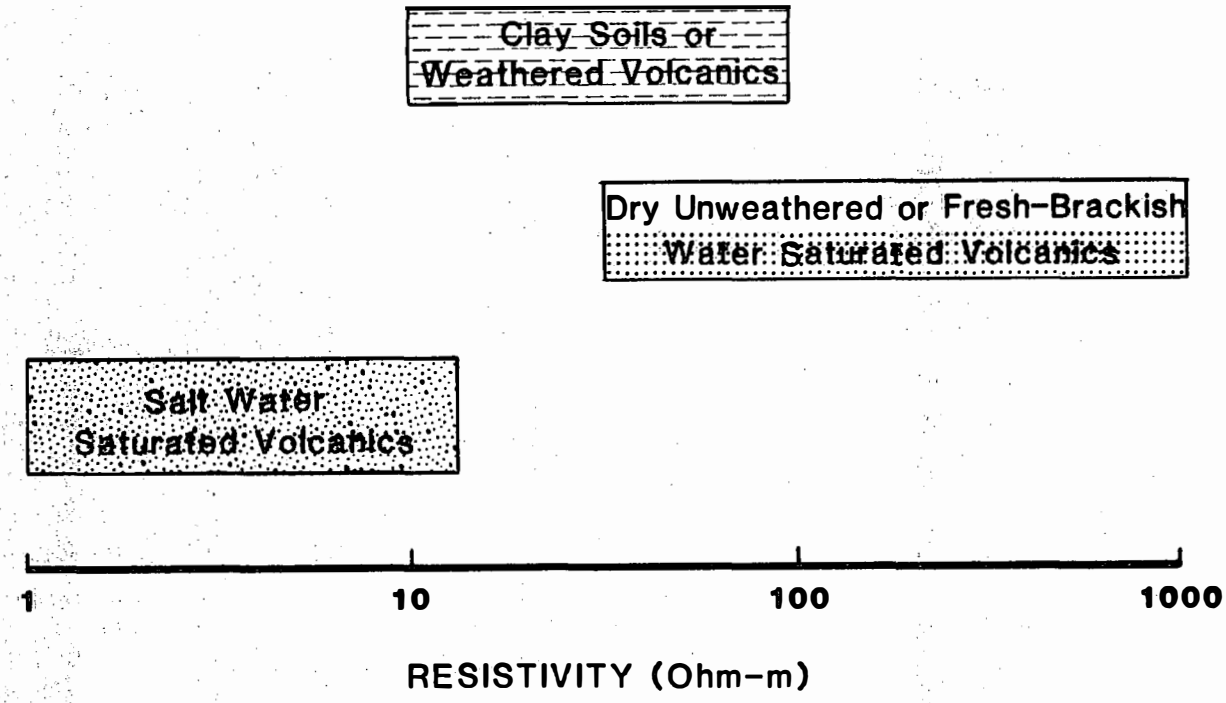
2. The roughly semi-circular pattern of equal hydrostatic head in the study area.

Previous estimates of fresh water hydrostatic head by Dale and Takasaki (1976) in the Central Aquifer area show the head to smoothly decrease towards the south away from the Schofield high-level aquifer (Fig. 4-7). This map shows the contours of equal hydrostatic head to be oriented in a west to east pattern. The apparent discrepancy between the contours derived by Dale and Takasaki, and the TDEM data, is likely due to low data density available to construct the contour map of Dale and Takasaki.

## 4.3 GEOELECTRIC CROSS-SECTION/WEST BEACH AREA

Line 1 North

Four TDEM soundings were acquired at the West Beach area as shown in Figure 2-2. The results of the geoelectric cross-section for Line 1N near West Beach are shown in Figure 4-8. The section shows an upper conductive zone interpreted as clay soils or weathered volcanics above sea level. The west portion of the line (soundings WB3W and WB2W) shows the fresh water - salt water interface to be very high in the section (about 100 ft below sea level). The fresh-salt water interface drops rapidly towards the east in the section to about -800 ft at WB1W. The rapid change in depth to saline water between WB2W and WB4W infers some type of ground water damming is likely at or near the ridge between soundings WB2W and WB4W. The calculated head levels at WB3W (2.3 ft) and WB1W (20.3 ft) show excellent agreement with known water well data in the area (personal communication with Tom Nance, 1990).

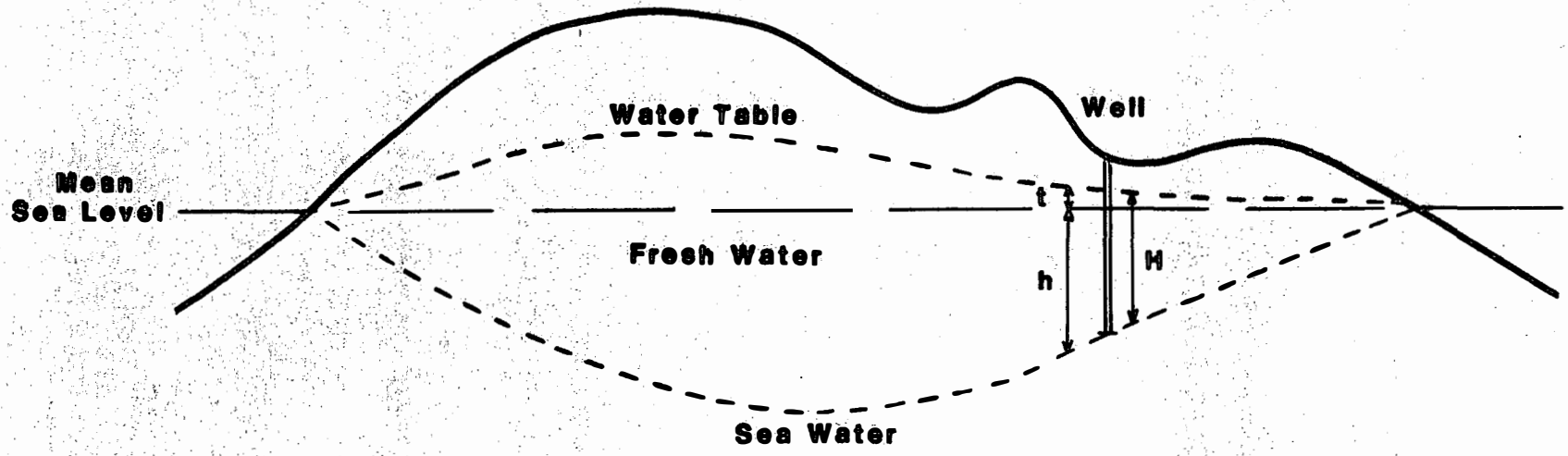



BLACKHAWK GEOSCIENCES, INC.

CHARACTERISTIC
RESISTIVITY RANGES

*Ewa Plains Water Dev. Corp.*

PROJECT NO.: 90006 FIGURE 4-1



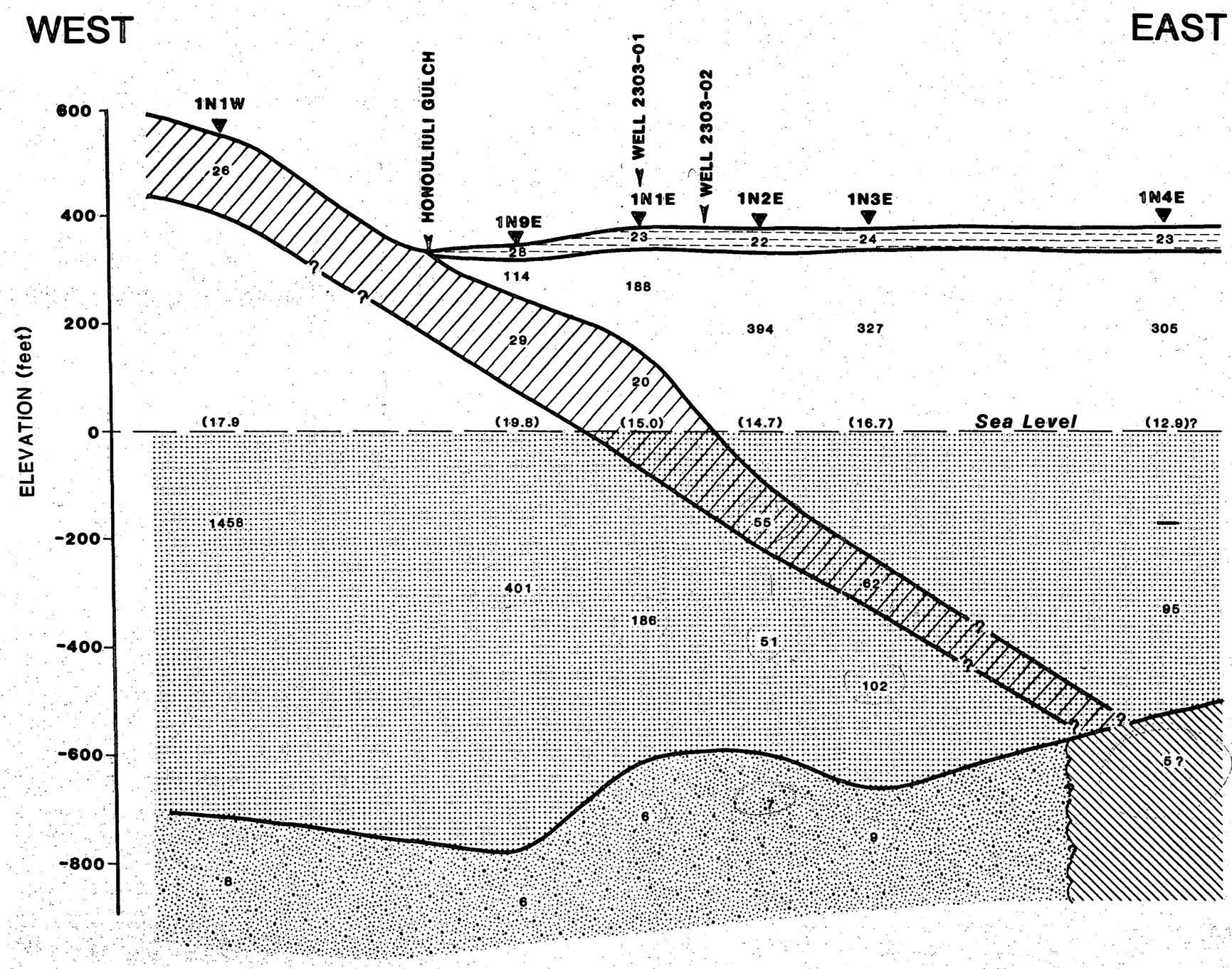

$t = 1/40\ (h)$

FROM: HERZBERG

BLACKHAWK GEOSCIENCES, INC.

Illustration of the
Ghyben-Herzberg Principle
*Ewa Plains Water Dev. Corp.*

PROJECT NO.: 90006 FIGURE 4-2




## LEGEND

100 Values in Ohm-m

(17) Hydrostatic Head (feet) of Fresh-Brackish Water Lens calculated from Ghyben-Herzberg principle

Clay Soils or Weathered Volcanics

Dry Unweathered Volcanics

Unconformity between the Waianae and Koolau lava flows

Fresh-Brackish Water Saturated Volcanics

Salt Water Saturated Volcanics

Salt Water Saturated Volcanics or Unconformity

1000 0 1000

SCALE - FEET

BLACKHAWK GEOSCIENCES, INC.

CROSS SECTION LINE 1 NORTH

*Ewa Plains Water Dev. Corp.*

*Central Aquifer Oahu, HI*

PROJECT NO.: 90006 FIGURE 4-3

## TDEM Sounding Results 1N1E (elv. 380 feet)

| Depth (ft) | Geoelectric Interpretation (computed static head = 15 ft) | Hydrologic Interpretation |
|---|---|---|
| 0 | | |
| | | Soil |
| 200 | | Dry Unweathered Volcanics |
| 1 | | |
| 400 | | Unconformity |
| 600 | | Fresh-Brackish Water Saturated Volcanics |
| 2 | | |
| 800 | | |
| 1000 | | Salt Water Saturated Volcanics |
| 3 | | |
| 1200 | | |
| 4 | | |

Depth (m x 100)

1 10 100 1000

RESISTIVITY (Ohm-m)

## Drilling Results

| Depth (ft) | Geologic Log of Upper Honouliuli Well #2303-01 (elev. 400 ft) (static head = 17 ft) |
|---|---|
| 0-50 | Red clay, loose cindery red mud |
| 50-225 | Mixture of Pahoehoe and aa fresh dark grey aa, with large cuttings of dense Pahoehoe |
| 225-379 | Increased weathering, med grey Pahoehoe mixture of reddish-brown and grey aa |
| 379-485 | Red mud and compacted clay (379-415') unconformity from geologic log |
| 485-TD | Mixture of reddish aa dark grey aa, grey Pahoehoe |
| TD 625' | |

BLACKHAWK GEOSCIENCES, INC.

COMPARISON OF SOUNDING 1N1E AND GEOLOGIC LOG WELL 2303-01

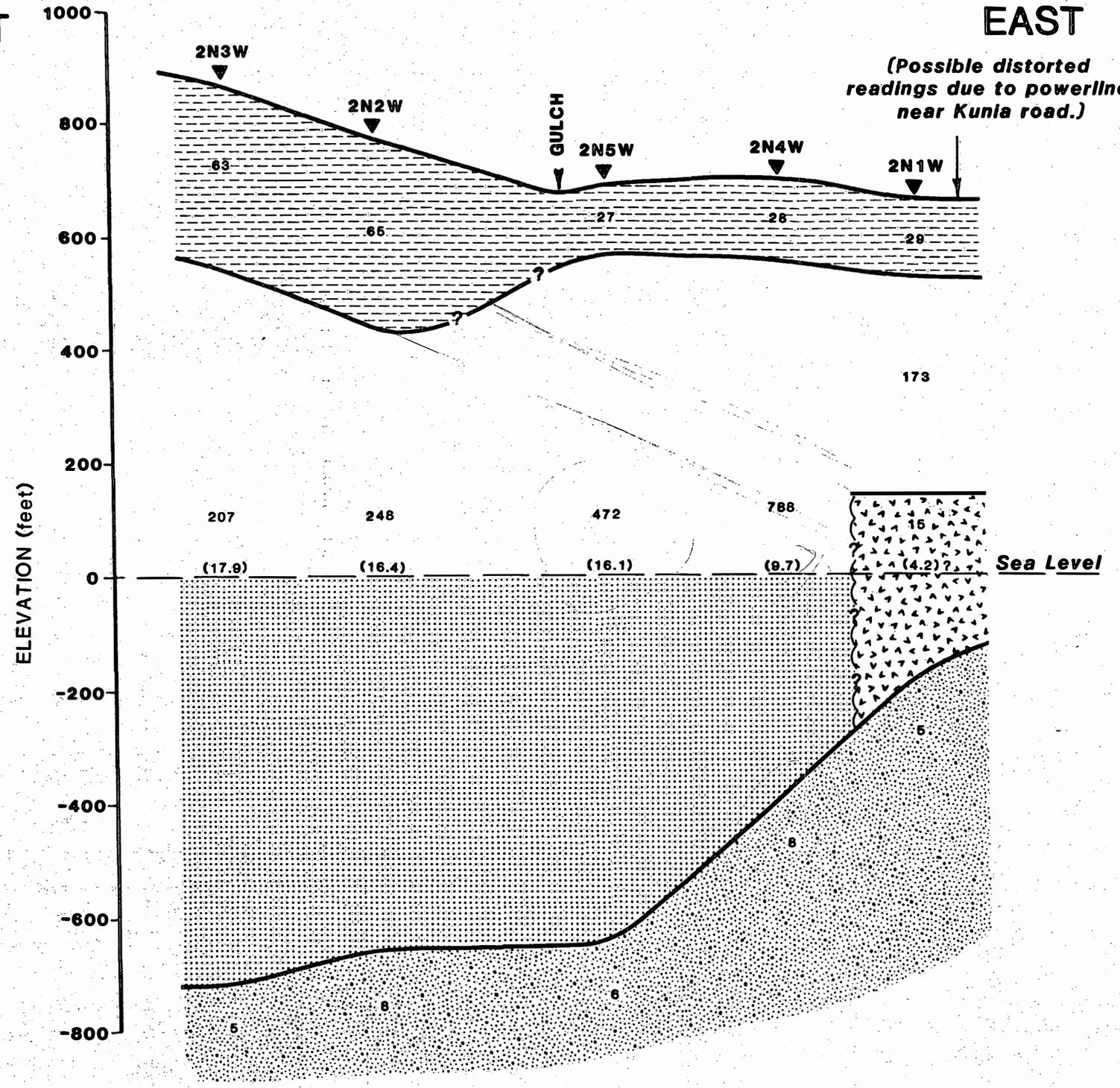
*Ewa Plains Water Dev. Corp.*
*Central Aquifer, Oahu, HI*

**PROJECT NO.: 90006** **FIGURE 4-4**

WEST

EAST

*(Possible distorted readings due to powerlines near Kunia road.)*




***LEGEND***

100 Values in Ohm-m

(17) Hydrostatic Head (feet) of Fresh-Brackish Water Lens calculated from Ghyben-Herzberg principle

Clay Soils or Weathered Volcanics

Dry Unweathered Volcanics

Fresh-Brackish Water Saturated Volcanics

Salt Water Saturated Volcanics

Weathered Volcanics or Unconformity

1000 0 1000

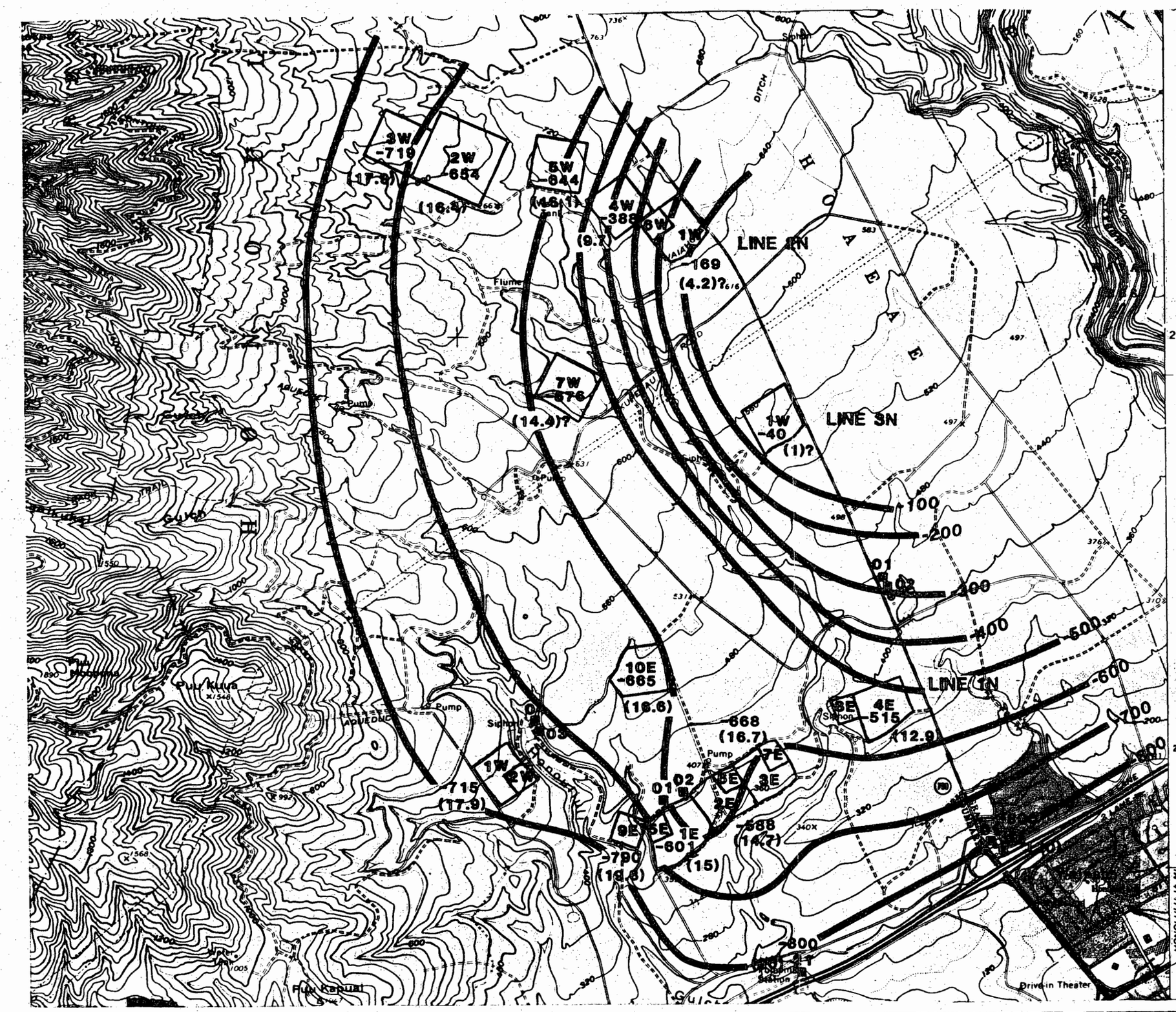
**BLACKHAWK GEOSCIENCES, INC.**

CROSS SECTION LINE 2 NORTH

*Ewa Plains Water Dev. Corp.*

*Central Aquifer Oahu, HI*

**PROJECT NO.: 90006** FIGURE 4-5




## LEGEND

- 1W □ — Sounding Loop Location
- 01 ■ — Well Locations and Number (2303-01)
- -600 — Elevation of Top of Salt Water Interface
- (15) — Hydrostatic Head (feet) of Fresh-Brackish Water Lens calculated from Ghyben-Herzberg Principle

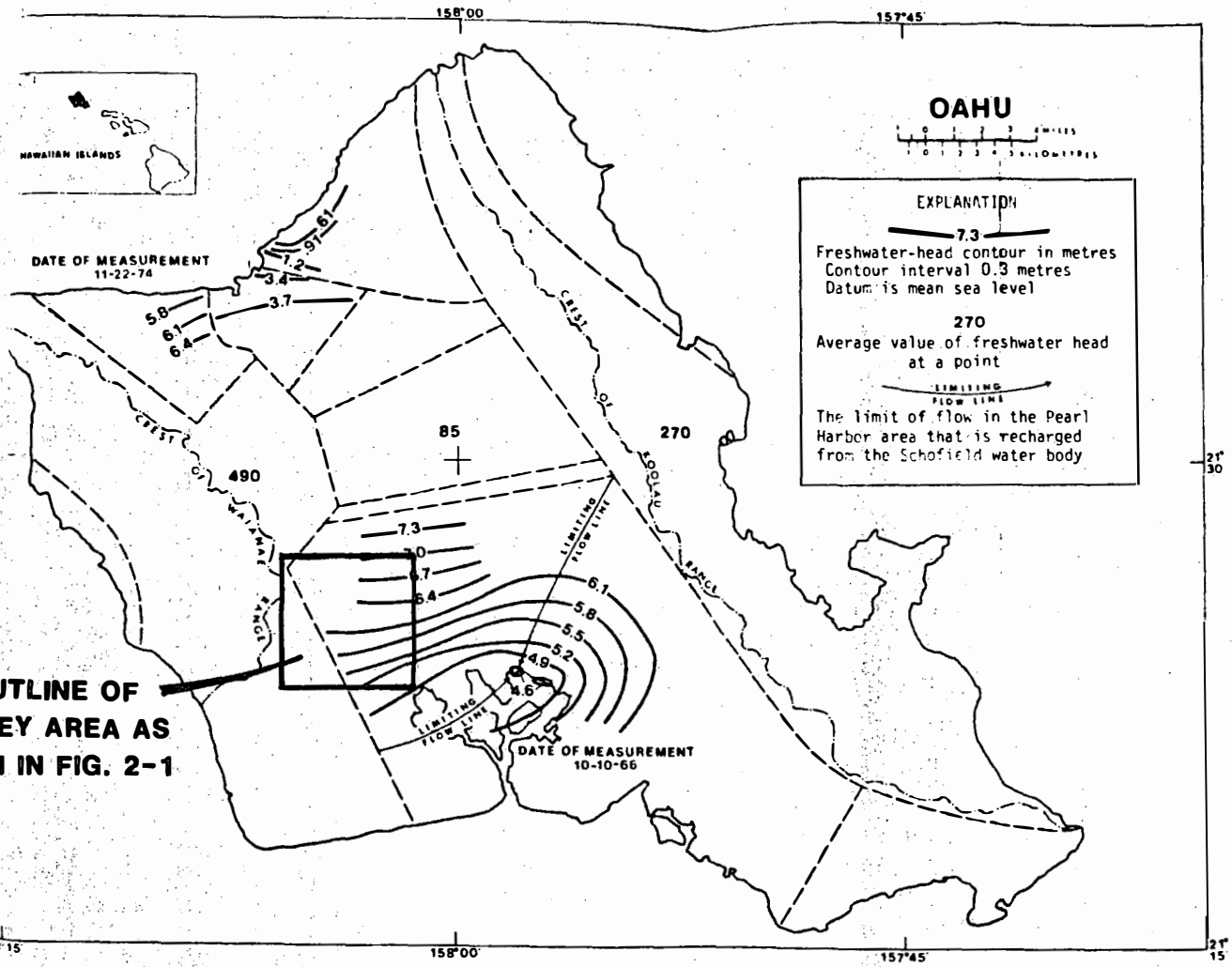
2000 0 2000

SCALE - FEET

**BLACKHAWK GEOSCIENCES, INC.**

TDEM Survey Contour Map
Top of Salt Water Interface
***Ewa Plains Water Dev. Corp.***
***Central Aquifer Oahu, HI***

**PROJECT NO.: 90006** FIGURE 4-6




**OUTLINE OF SURVEY AREA AS SHOWN IN FIG. 2-1**

**FROM: Dale and Takasaki. USGS Water-Resources Investigation, MF 76-47 May, 1976.**

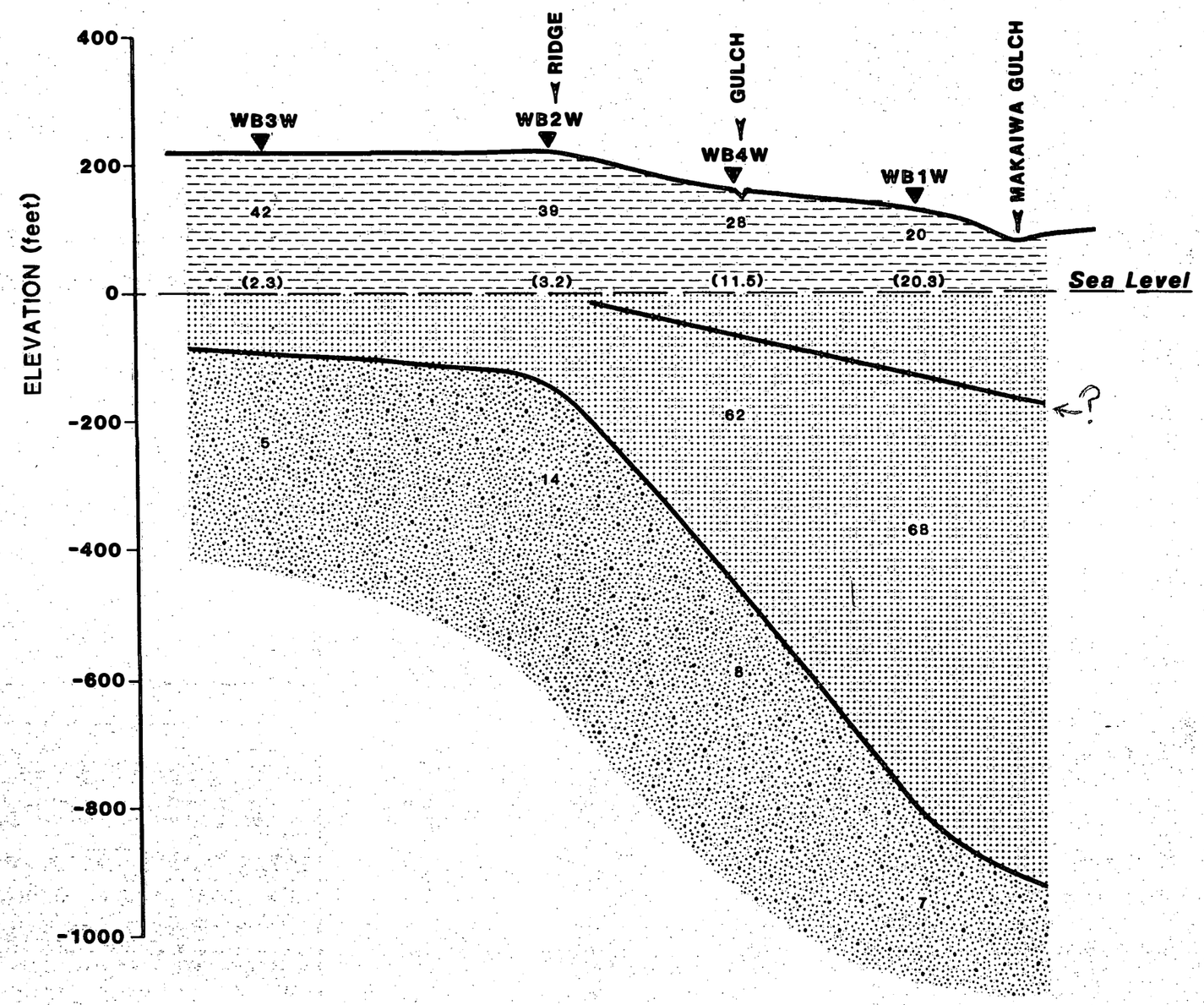
**BLACKHAWK GEOSCIENCES, INC.**

FRESHWATER-HEAD MAP

***Ewa Plains Water Dev. Corp.***

***Central Aquifer, Oahu, HI***

**PROJECT NO.: 90006** FIGURE 4-7




***LEGEND***

100 Values in Ohm-m

(17) Hydrostatic Head (feet) of Fresh-Brackish Water Lens calculated from Ghyben-Herzberg principle

Clay Soils or Weathered Volcanics

Dry Unweathered Volcanics

Fresh-Brackish Water Saturated Volcanics

Salt Water Saturated Volcanics

500 0 500

SCALE - FEET

**BLACKHAWK GEOSCIENCES, INC.**

CROSS SECTION LINE 1 NORTH

*Ewa Plains Water Dev. Corp.*

*West Beach, Oahu, HI*

PROJECT NO.: 90006 FIGURE 4-8

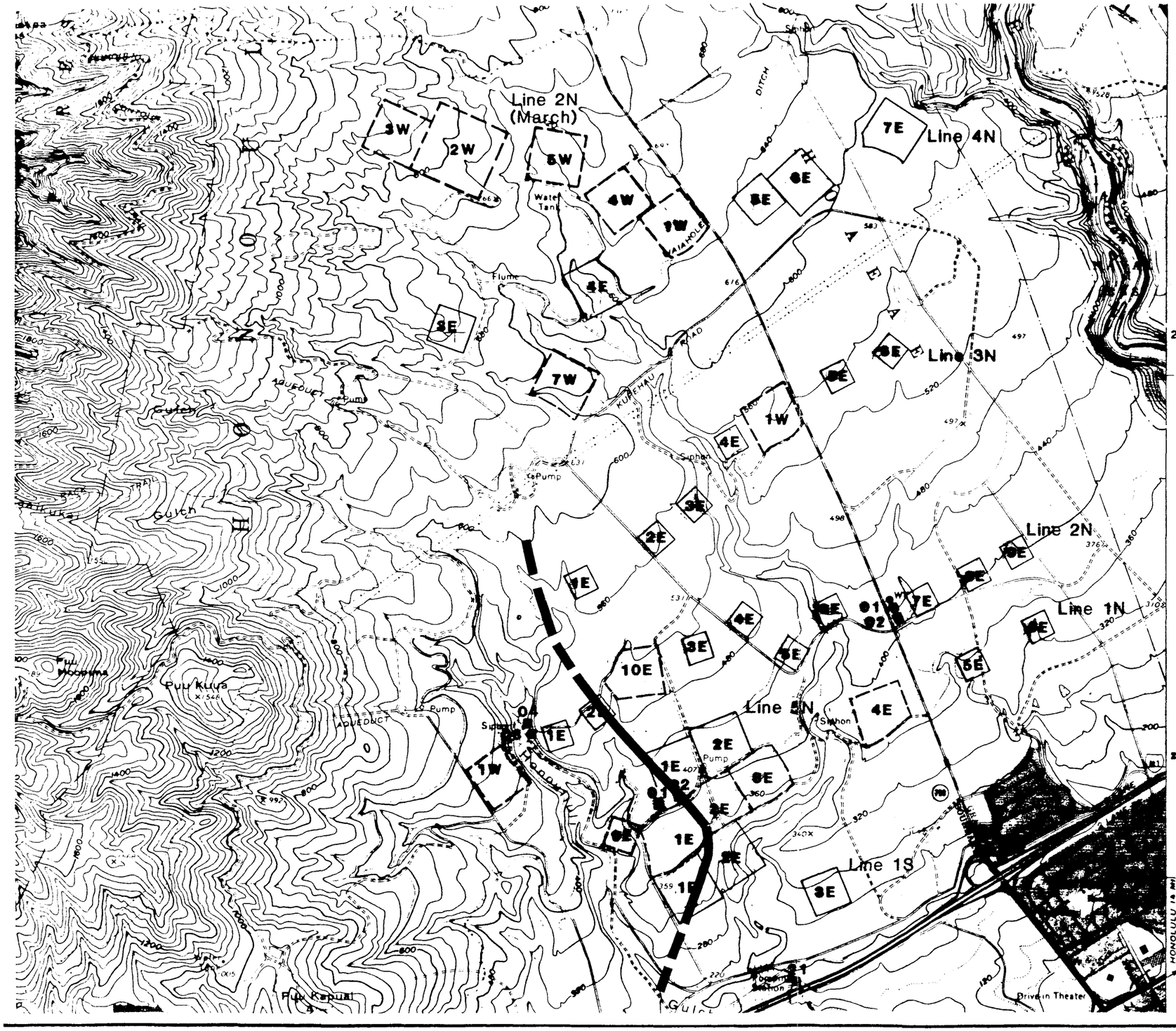
## 5.0 CONCLUSIONS

The results of TDEM soundings taken in the Central Aquifer area are summarized in the contour map of the top of the salt water interface (Fig. 4-6). The contour map shows that in the area surveyed a decreasing hydrostatic head occurs towards station 3N1W (near the intersection of Kunia Road and the large power line). This pattern differs from the previously published fresh water head contour data by Dale and Takasaki (Fig. 4-7) who show heads to decrease smoothly towards the south from the Schofield high-level aquifer. Because the contour map of Dale and Takasaki is based upon sparse data density, it is mainly the higher data density of the present TDEM survey that suggests a different behavior for the contours.

In the Central Aquifer area the TDEM soundings taken near wells at the 400 ft elevation (Fig. 4-5, line 1N) show good agreement with borehole data in depth to the unconformity between the Koolau and Wainae flows and in the depth to fresh-brackish water. TDEM soundings taken at other locations failed to detect the unconformity. However, data density across much of the Central Aquifer area was inadequate to properly define the existence of the unconformity. The low data density was mainly due to property access restrictions imposed during the field survey.

TDEM soundings taken at the West Beach area (Figs. 2-2 and 4-5) show excellent agreement with water well data in the area, and indicate that a hydrologic barrier (possibly a dike) exists in the vicinity of soundings WB2W and WB4W.

In the Central Aquifer area additional TDEM soundings would be helpful to better define the orientation of the unconformity between the Koolau and Waianae flows detected on Line 1N. Additional data between Lines 1N and 2N and east of Kunia Road would also help to define the position of the fresh water head in this area.




*LEGEND*

- 1W — Sounding Loop Location
- 1W — March 1990 Survey
- 01 — Well Locations and Number (2303-01)
- Location of unconformity at sea level dashed where approximate


2000 0 2000

SCALE - FEET

**BLACKHAWK GEOSCIENCES, INC.**

GEOPHYSICAL SURVEY
INTERPRETATION MAP
***Ewa Plains Water Dev. Corp.***
***Central Oahu, Hi.***

**PROJECT NO: 90034** Figure 5-1

**ATTACHMENT**

# GEOPHYSICAL SURVEYS FOR GROUND WATER EVALUATION CENTRAL AQUIFER AND WEST BEACH AREAS OAHU, HAWAII

**ATTACHMENT**

# GEOPHYSICAL SURVEYS FOR GROUND WATER EVALUATION CENTRAL AQUIFER AND WEST BEACH AREAS OAHU, HAWAII

**Prepared For:**

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**Suite 500, 828 Fort Street Mall**
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**Prepared By:**

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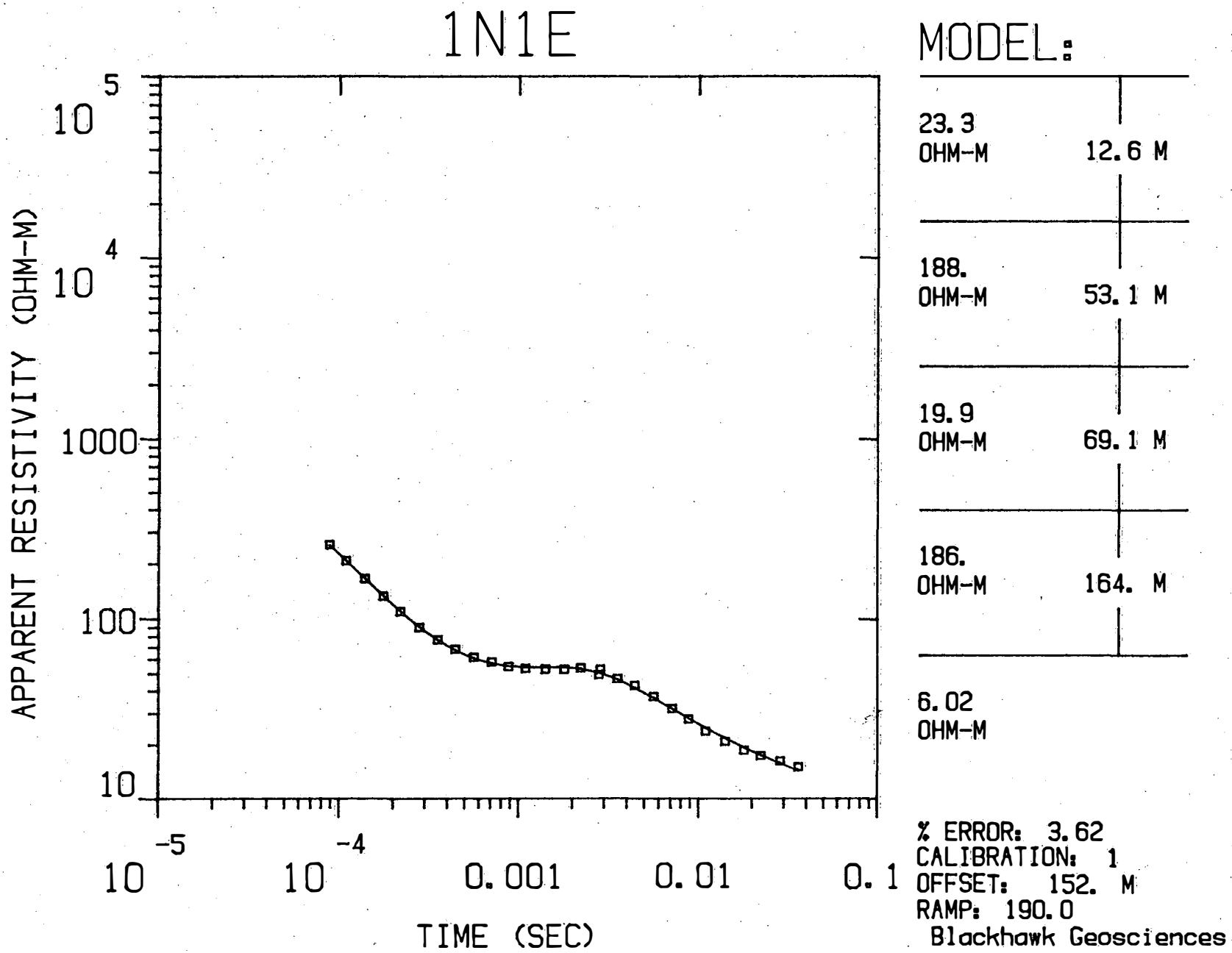
**17301 West Colfax Avenue, Suite 170**
**Golden, CO 80401**

**April 10, 1990**

**(Our Project #90006)**


1N1E
APPARENT RESISTIVITY (OHM-M)
10^5
10^4
1000
100
10
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
MODEL:
23.3
OHM-M
12.6 M
188.
OHM-M
53.1 M
19.9
OHM-M
69.1 M
186.
OHM-M
164. M
6.02
OHM-M
% ERROR: 3.62
CALIBRATION: 1
OFFSET: 152. M
RAMP: 190.0
Blackhawk Geosciences

1N1E

MODEL: 5 LAYERS

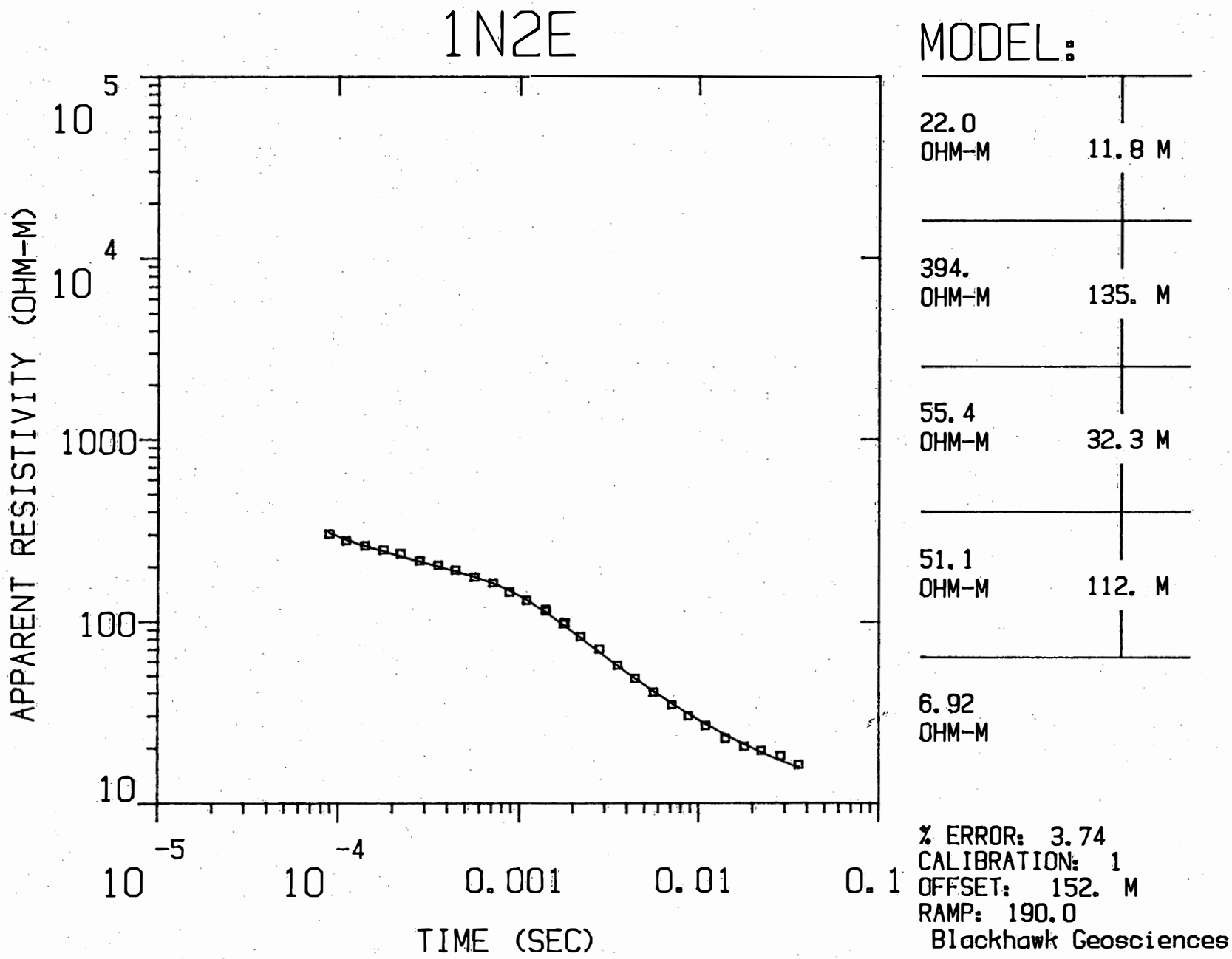
| RESISTIVITY (OHM-M) | THICKNESS (M) | ELEVATION (M) | ELEVATION (FEET) | CONDUCTANCE (S) LAYER | CONDUCTANCE (S) TOTAL |
|---|---|---|---|---|---|
| | | 115.8 | 380.0 | | |
| 23.28 | 12.6 | 103.2 | 338.6 | 0.5 | 0.5 |
| 187.51 | 53.1 | 50.1 | 164.5 | 0.3 | 0.8 |
| 19.92 | 69.1 | -18.9 | -62.1 | 3.5 | 4.3 |
| 185.71 | 164.2 | -183.2 | -600.9 | 0.9 | 5.2 |
| 6.02 | | | | | |

| | TIMES | DATA | CALC | % ERROR | STD ERR |
|---|---|---|---|---|---|
| 1 | 8.90E-05 | 2.55E+02 | 2.53E+02 | 0.593 | |
| 2 | 1.10E-04 | 2.08E+02 | 2.08E+02 | -0.027 | |
| 3 | 1.40E-04 | 1.66E+02 | 1.66E+02 | -0.434 | |
| 4 | 1.77E-04 | 1.33E+02 | 1.34E+02 | -0.872 | |
| 5 | 2.20E-04 | 1.10E+02 | 1.10E+02 | -0.393 | |
| 6 | 2.80E-04 | 8.98E+01 | 9.04E+01 | -0.659 | |
| 7 | 3.55E-04 | 7.69E+01 | 7.64E+01 | 0.563 | |
| 8 | 4.43E-04 | 6.80E+01 | 6.73E+01 | 1.105 | |
| 9 | 5.64E-04 | 6.13E+01 | 6.06E+01 | 1.135 | |
| 10 | 7.13E-04 | 5.79E+01 | 5.67E+01 | 2.179 | |
| 11 | 8.81E-04 | 5.45E+01 | 5.48E+01 | -0.481 | |
| 12 | 1.10E-03 | 5.34E+01 | 5.40E+01 | -1.242 | |
| 13 | 1.41E-03 | 5.28E+01 | 5.40E+01 | -2.221 | |
| 14 | 1.80E-03 | 5.27E+01 | 5.40E+01 | -2.503 | |
| 15 | 2.22E-03 | 5.37E+01 | 5.31E+01 | 1.124 | |
| 16 | 2.80E-03 | 4.92E+01 | 5.05E+01 | -2.605 | |
| 17 | 2.85E-03 | 5.28E+01 | 5.03E+01 | 5.009 | |
| 18 | 3.55E-03 | 4.68E+01 | 4.64E+01 | 0.906 | |
| 19 | 4.43E-03 | 4.31E+01 | 4.17E+01 | 3.379 | |
| 20 | 5.64E-03 | 3.72E+01 | 3.65E+01 | 2.107 | |
| 21 | 7.13E-03 | 3.19E+01 | 3.19E+01 | 0.173 | |
| 22 | 8.81E-03 | 2.79E+01 | 2.82E+01 | -1.072 | |
| 23 | 1.10E-02 | 2.39E+01 | 2.50E+01 | -4.429 | |
| 24 | 1.41E-02 | 2.09E+01 | 2.18E+01 | -4.212 | |
| 25 | 1.80E-02 | 1.86E+01 | 1.94E+01 | -3.678 | |
| 26 | 2.22E-02 | 1.74E+01 | 1.75E+01 | -0.790 | |
| 27 | 2.85E-02 | 1.62E+01 | 1.57E+01 | 3.028 | |
| 28 | 3.60E-02 | 1.51E+01 | 1.44E+01 | 4.853 | |

R: 152. X: 0. Y: 152. DL: 305. REQ: 169. CF: 1.0000
TDHZ ARRAY, 28 DATA POINTS, RAMP: 190.0 MICROSEC, DATA: 1N1E
1303 001N 001E Z OPR XTL L 5 10+1000
Ch.21 = 0.19 Ch.22 = 0.89 Ch.23 = 17.5 Ch.24 =
RMS LOG ERROR: 1.54E-02, ANTILOG YIELDS 3.6177 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Inc. *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER
P 1 0.36
P 2 0.09 0.03
P 3 0.00 0.03 0.66


1N2E
APPARENT RESISTIVITY (OHM-M)
10^5
10^4
1000
100
10
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
MODEL:
22.0
OHM-M
11.8 M
394.
OHM-M
135. M
55.4
OHM-M
32.3 M
51.1
OHM-M
112. M
6.92
OHM-M
% ERROR: 3.74
CALIBRATION: 1
OFFSET: 152. M
RAMP: 190.0
Blackhawk Geosciences

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| P 4 | -0.00 | -0.00 | 0.04 | -0.01 | | | | | |
| P 5 | -0.02 | -0.01 | 0.01 | -0.01 | 0.58 | | | | |
| T 1 | -0.26 | -0.06 | 0.04 | 0.00 | 0.03 | 0.20 | | | |
| T 2 | 0.23 | 0.09 | 0.19 | -0.01 | 0.03 | -0.07 | 0.60 | | |
| T 3 | 0.01 | -0.01 | -0.36 | -0.04 | 0.10 | 0.03 | 0.14 | 0.40 | |
| T 4 | -0.03 | -0.01 | 0.07 | 0.05 | 0.13 | 0.04 | 0.03 | 0.09 | 0.84 |
| | P 1 | P 2 | P 3 | P 4 | P 5 | T 1 | T 2 | T 3 | T 4 |

1N2E

MODEL: 5 LAYERS

| RESISTIVITY (OHM-M) | THICKNESS (M) | ELEVATION (M) | ELEVATION (FEET) | CONDUCTANCE (S) LAYER | CONDUCTANCE (S) TOTAL |
|---|---|---|---|---|---|
| | | 112.8 | 370.0 | | |
| 21.99 | 11.8 | 100.9 | 331.2 | 0.5 | 0.5 |
| 394.16 | 135.5 | -34.5 | -113.3 | 0.3 | 0.9 |
| 55.43 | 32.3 | -66.8 | -219.2 | 0.6 | 1.5 |
| 51.10 | 112.4 | -179.2 | -588.1 | 2.2 | 3.7 |
| 6.92 | | | | | |

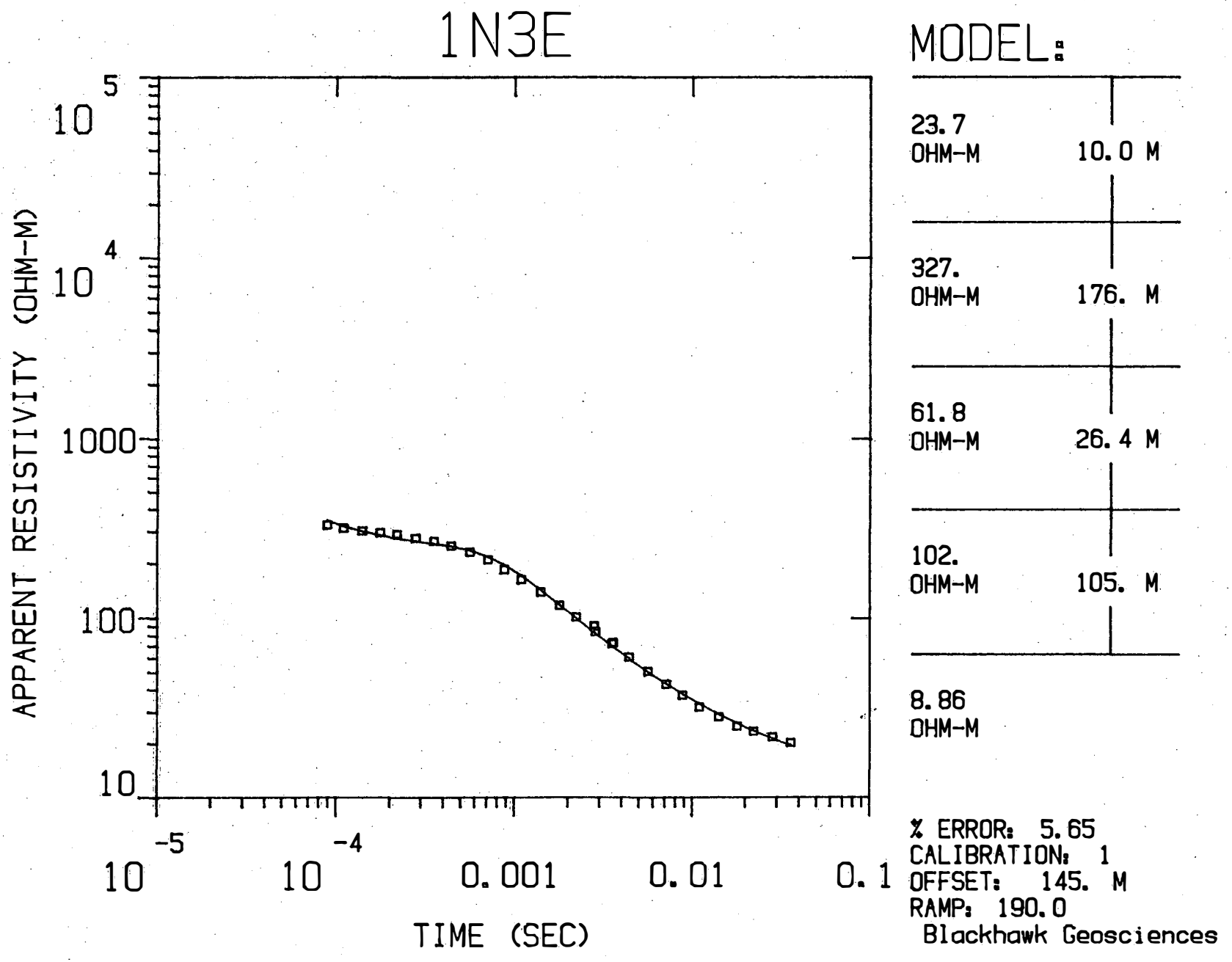
| | TIMES | DATA | CALC | % ERROR | STD ERR |
|---|---|---|---|---|---|
| 1 | 8.90E-05 | 3.03E+02 | 3.09E+02 | -1.864 | |
| 2 | 1.10E-04 | 2.78E+02 | 2.83E+02 | -1.576 | |
| 3 | 1.40E-04 | 2.61E+02 | 2.61E+02 | 0.101 | |
| 4 | 1.77E-04 | 2.48E+02 | 2.44E+02 | 1.575 | |
| 5 | 2.20E-04 | 2.36E+02 | 2.30E+02 | 2.934 | |
| 6 | 2.80E-04 | 2.16E+02 | 2.15E+02 | 0.715 | |
| 7 | 3.55E-04 | 2.04E+02 | 2.01E+02 | 1.622 | |
| 8 | 4.43E-04 | 1.92E+02 | 1.90E+02 | 1.271 | |
| 9 | 5.64E-04 | 1.76E+02 | 1.77E+02 | -0.629 | |
| 10 | 7.13E-04 | 1.63E+02 | 1.63E+02 | 0.094 | |
| 11 | 8.81E-04 | 1.45E+02 | 1.49E+02 | -2.382 | |
| 12 | 1.10E-03 | 1.31E+02 | 1.32E+02 | -1.030 | |
| 13 | 1.40E-03 | 1.17E+02 | 1.13E+02 | 3.444 | |
| 14 | 1.41E-03 | 1.14E+02 | 1.13E+02 | 1.671 | |
| 15 | 1.77E-03 | 9.69E+01 | 9.57E+01 | 1.338 | |
| 16 | 1.80E-03 | 9.88E+01 | 9.47E+01 | 4.362 | |
| 17 | 2.20E-03 | 8.26E+01 | 8.13E+01 | 1.653 | |
| 18 | 2.80E-03 | 7.02E+01 | 6.77E+01 | 3.737 | |
| 19 | 3.55E-03 | 5.70E+01 | 5.67E+01 | 0.590 | |
| 20 | 4.43E-03 | 4.83E+01 | 4.83E+01 | -0.116 | |
| 21 | 5.64E-03 | 4.04E+01 | 4.09E+01 | -1.182 | |
| 22 | 7.13E-03 | 3.45E+01 | 3.51E+01 | -1.655 | |
| 23 | 8.81E-03 | 3.00E+01 | 3.08E+01 | -2.679 | |
| 24 | 1.10E-02 | 2.65E+01 | 2.71E+01 | -2.401 | |
| 25 | 1.41E-02 | 2.26E+01 | 2.37E+01 | -4.769 | |
| 26 | 1.80E-02 | 2.05E+01 | 2.10E+01 | -2.666 | |
| 27 | 2.22E-02 | 1.94E+01 | 1.90E+01 | 1.905 | |
| 28 | 2.85E-02 | 1.81E+01 | 1.72E+01 | 5.741 | |
| 29 | 3.60E-02 | 1.62E+01 | 1.57E+01 | 3.347 | |

R: 152. X: 0. Y: 152. DL: 305. REQ: 169. CF: 1.0000
TDHZ ARRAY, 29 DATA POINTS, RAMP: 190.0 MICROSEC, DATA: 1N2E
1303 001N 0002 Z OPR XTL L 5 10+1000
Ch.21 = 0.19 Ch.22 = 0.89 Ch.23 = 17.5 Ch.24 =
RMS LOG ERROR: 1.59E-02, ANTILOG YIELDS 3.7404 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Inc. *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER
P 1 0.61
P 2 0.04 0.16

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| P 3 | -0.02 | 0.07 | 0.13 | | | | | | |
| P 4 | 0.08 | -0.09 | 0.11 | 0.43 | | | | | |
| P 5 | 0.00 | 0.00 | 0.00 | -0.02 | 0.99 | | | | |
| T 1 | -0.43 | -0.16 | 0.01 | 0.10 | 0.00 | 0.47 | | | |
| T 2 | -0.02 | 0.16 | 0.19 | 0.15 | 0.00 | 0.00 | 0.86 | | |
| T 3 | 0.02 | -0.06 | -0.08 | -0.03 | 0.00 | 0.01 | 0.02 | 0.08 | |
| T 4 | 0.07 | -0.15 | -0.21 | -0.11 | 0.00 | 0.06 | 0.14 | 0.25 | 0.77 |
| | P 1 | P 2 | P 3 | P 4 | P 5 | T 1 | T 2 | T 3 | T 4 |


1N3E
APPARENT RESISTIVITY (OHM-M)
10^5
10^4
1000
100
10
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
MODEL:
23.7
OHM-M
10.0 M
327.
OHM-M
176. M
61.8
OHM-M
26.4 M
102.
OHM-M
105. M
8.86
OHM-M
% ERROR: 5.65
CALIBRATION: 1
OFFSET: 145. M
RAMP: 190.0
Blackhawk Geosciences

1N3E

MODEL: 5 LAYERS

| RESISTIVITY (OHM-M) | THICKNESS (M) | ELEVATION (M) | ELEVATION (FEET) | CONDUCTANCE (S) LAYER | CONDUCTANCE (S) TOTAL |
|---|---|---|---|---|---|
| | | 114.3 | 375.0 | | |
| 23.73 | 10.0 | 104.3 | 342.1 | 0.4 | 0.4 |
| 327.23 | 176.3 | -72.0 | -236.3 | 0.5 | 1.0 |
| 61.85 | 26.4 | -98.4 | -322.9 | 0.4 | 1.4 |
| 101.62 | 105.3 | -203.7 | -668.4 | 1.0 | 2.4 |
| 8.86 | | | | | |

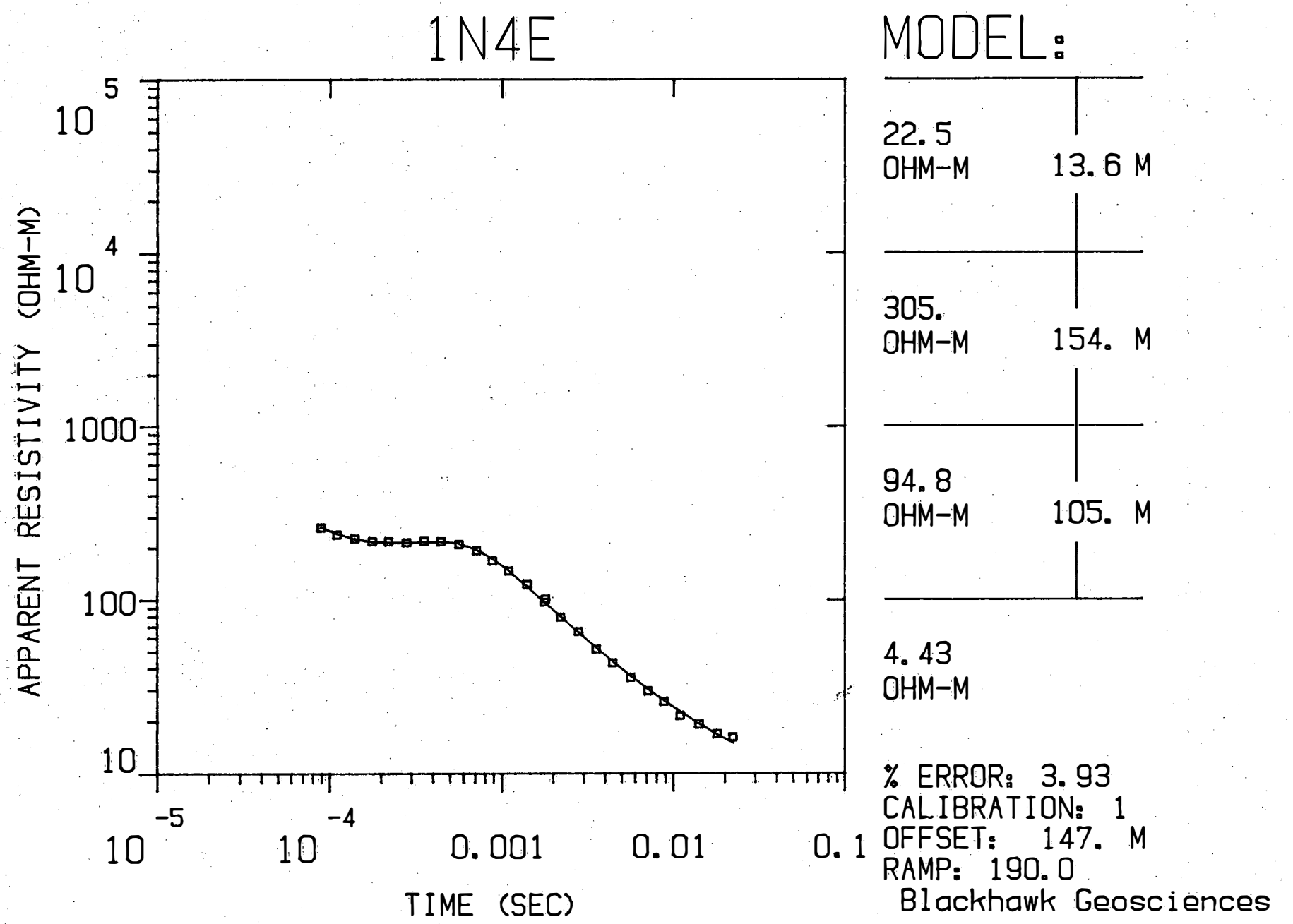
| | TIMES | DATA | CALC | % ERROR | STD ERR |
|---|---|---|---|---|---|
| 1 | 8.90E-05 | 3.26E+02 | 3.46E+02 | -5.737 | |
| 2 | 1.10E-04 | 3.13E+02 | 3.22E+02 | -2.646 | |
| 3 | 1.40E-04 | 3.02E+02 | 3.01E+02 | 0.321 | |
| 4 | 1.77E-04 | 2.95E+02 | 2.86E+02 | 3.276 | |
| 5 | 2.20E-04 | 2.90E+02 | 2.75E+02 | 5.524 | |
| 6 | 2.80E-04 | 2.75E+02 | 2.65E+02 | 3.959 | |
| 7 | 3.55E-04 | 2.65E+02 | 2.57E+02 | 3.189 | |
| 8 | 4.43E-04 | 2.50E+02 | 2.49E+02 | 0.504 | |
| 9 | 5.64E-04 | 2.30E+02 | 2.36E+02 | -2.464 | |
| 10 | 7.13E-04 | 2.09E+02 | 2.18E+02 | -4.131 | |
| 11 | 8.81E-04 | 1.85E+02 | 1.97E+02 | -5.986 | |
| 12 | 1.10E-03 | 1.63E+02 | 1.72E+02 | -5.131 | |
| 13 | 1.41E-03 | 1.39E+02 | 1.43E+02 | -2.847 | |
| 14 | 1.80E-03 | 1.18E+02 | 1.19E+02 | -0.889 | |
| 15 | 2.22E-03 | 1.02E+02 | 1.00E+02 | 1.612 | |
| 16 | 2.80E-03 | 9.06E+01 | 8.38E+01 | 8.137 | |
| 17 | 2.85E-03 | 8.42E+01 | 8.26E+01 | 1.912 | |
| 18 | 3.55E-03 | 7.26E+01 | 7.00E+01 | 3.688 | |
| 19 | 3.60E-03 | 7.32E+01 | 6.93E+01 | 5.612 | |
| 20 | 4.43E-03 | 6.09E+01 | 5.96E+01 | 2.150 | |
| 21 | 5.64E-03 | 5.08E+01 | 5.05E+01 | 0.656 | |
| 22 | 7.13E-03 | 4.30E+01 | 4.33E+01 | -0.670 | |
| 23 | 8.81E-03 | 3.75E+01 | 3.81E+01 | -1.515 | |
| 24 | 1.10E-02 | 3.21E+01 | 3.36E+01 | -4.479 | |
| 25 | 1.41E-02 | 2.83E+01 | 2.94E+01 | -3.461 | |
| 26 | 1.80E-02 | 2.51E+01 | 2.61E+01 | -3.810 | |
| 27 | 2.22E-02 | 2.35E+01 | 2.37E+01 | -0.921 | |
| 28 | 2.85E-02 | 2.18E+01 | 2.14E+01 | 2.191 | |
| 29 | 3.60E-02 | 2.03E+01 | 1.96E+01 | 3.484 | |

R: 145. X: 0. Y: 145. DL: 290. REQ: 161. CF: 1.0000
TDHZ ARRAY, 29 DATA POINTS, RAMP: 190.0 MICROSEC, DATA: 1N3E
1403 001N 0003 Z OPR XTL H 3 8+100
Ch.21 = 0.19 Ch.22 = 0.089 Ch.23 = 20 Ch.24 = 8
RMS LOG ERROR: 2.39E-02, ANTILOG YIELDS 5.6509 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Inc. *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER
P 1 0.45
P 2 0.18 0.20

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| P 3 | 0.00 | 0.07 | -0.04 | | | | | | |
| P 4 | -0.01 | 0.04 | 0.03 | 0.03 | | | | | |
| P 5 | 0.01 | -0.04 | -0.03 | -0.04 | 0.68 | | | | |
| T 1 | -0.41 | -0.20 | -0.01 | 0.00 | 0.00 | 0.39 | | | |
| T 2 | 0.02 | 0.11 | 0.08 | 0.09 | 0.02 | 0.01 | 0.79 | | |
| T 3 | 0.00 | -0.05 | -0.03 | -0.02 | 0.04 | 0.01 | 0.05 | 0.04 | |
| T 4 | 0.00 | -0.11 | -0.06 | -0.03 | 0.09 | 0.05 | 0.29 | 0.10 | 0.32 |
| | P 1 | P 2 | P 3 | P 4 | P 5 | T 1 | T 2 | T 3 | T 4 |


1N4E
APPARENT RESISTIVITY (OHM-M)
10^5
10^4
1000
100
10
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
MODEL:
22.5
OHM-M
13.6 M
305.
OHM-M
154. M
94.8
OHM-M
105. M
4.43
OHM-M
% ERROR: 3.93
CALIBRATION: 1
OFFSET: 147. M
RAMP: 190.0
Blackhawk Geosciences

1N4E

MODEL: 4 LAYERS

| RESISTIVITY (OHM-M) | THICKNESS (M) | ELEVATION (M) | ELEVATION (FEET) | CONDUCTANCE (S) LAYER | CONDUCTANCE (S) TOTAL |
|---|---|---|---|---|---|
| | | 115.8 | 380.0 | | |
| 22.45 | 13.6 | 102.3 | 335.5 | 0.6 | 0.6 |
| 304.76 | 154.0 | -51.8 | -169.8 | 0.5 | 1.1 |
| 94.83 | 105.2 | -157.0 | -515.0 | 1.1 | 2.2 |
| 4.43 | | | | | |

| | TIMES | DATA | CALC | % ERROR | STD ERR |
|---|---|---|---|---|---|
| 1 | 8.90E-05 | 2.61E+02 | 2.63E+02 | -0.803 | |
| 2 | 1.10E-04 | 2.38E+02 | 2.41E+02 | -1.255 | |
| 3 | 1.40E-04 | 2.26E+02 | 2.25E+02 | 0.406 | |
| 4 | 1.77E-04 | 2.17E+02 | 2.16E+02 | 0.478 | |
| 5 | 2.20E-04 | 2.17E+02 | 2.13E+02 | 1.690 | |
| 6 | 2.80E-04 | 2.14E+02 | 2.14E+02 | 0.067 | |
| 7 | 3.55E-04 | 2.18E+02 | 2.16E+02 | 0.911 | |
| 8 | 4.43E-04 | 2.17E+02 | 2.17E+02 | -0.145 | |
| 9 | 5.64E-04 | 2.09E+02 | 2.11E+02 | -1.104 | |
| 10 | 7.13E-04 | 1.92E+02 | 1.95E+02 | -1.493 | |
| 11 | 8.81E-04 | 1.68E+02 | 1.73E+02 | -2.757 | |
| 12 | 1.10E-03 | 1.47E+02 | 1.48E+02 | -0.307 | |
| 13 | 1.40E-03 | 1.24E+02 | 1.20E+02 | 3.514 | |
| 14 | 1.41E-03 | 1.22E+02 | 1.19E+02 | 2.797 | |
| 15 | 1.77E-03 | 9.69E+01 | 9.71E+01 | -0.225 | |
| 16 | 1.80E-03 | 1.01E+02 | 9.59E+01 | 5.537 | |
| 17 | 2.20E-03 | 7.93E+01 | 7.98E+01 | -0.669 | |
| 18 | 2.80E-03 | 6.52E+01 | 6.44E+01 | 1.168 | |
| 19 | 3.55E-03 | 5.16E+01 | 5.25E+01 | -1.759 | |
| 20 | 4.43E-03 | 4.29E+01 | 4.37E+01 | -1.928 | |
| 21 | 5.64E-03 | 3.52E+01 | 3.61E+01 | -2.410 | |
| 22 | 7.13E-03 | 2.95E+01 | 3.03E+01 | -2.444 | |
| 23 | 8.81E-03 | 2.57E+01 | 2.60E+01 | -1.282 | |
| 24 | 1.10E-02 | 2.13E+01 | 2.25E+01 | -5.286 | |
| 25 | 1.41E-02 | 1.90E+01 | 1.92E+01 | -0.859 | |
| 26 | 1.80E-02 | 1.68E+01 | 1.67E+01 | 0.610 | |
| 27 | 2.22E-02 | 1.61E+01 | 1.49E+01 | 7.977 | |

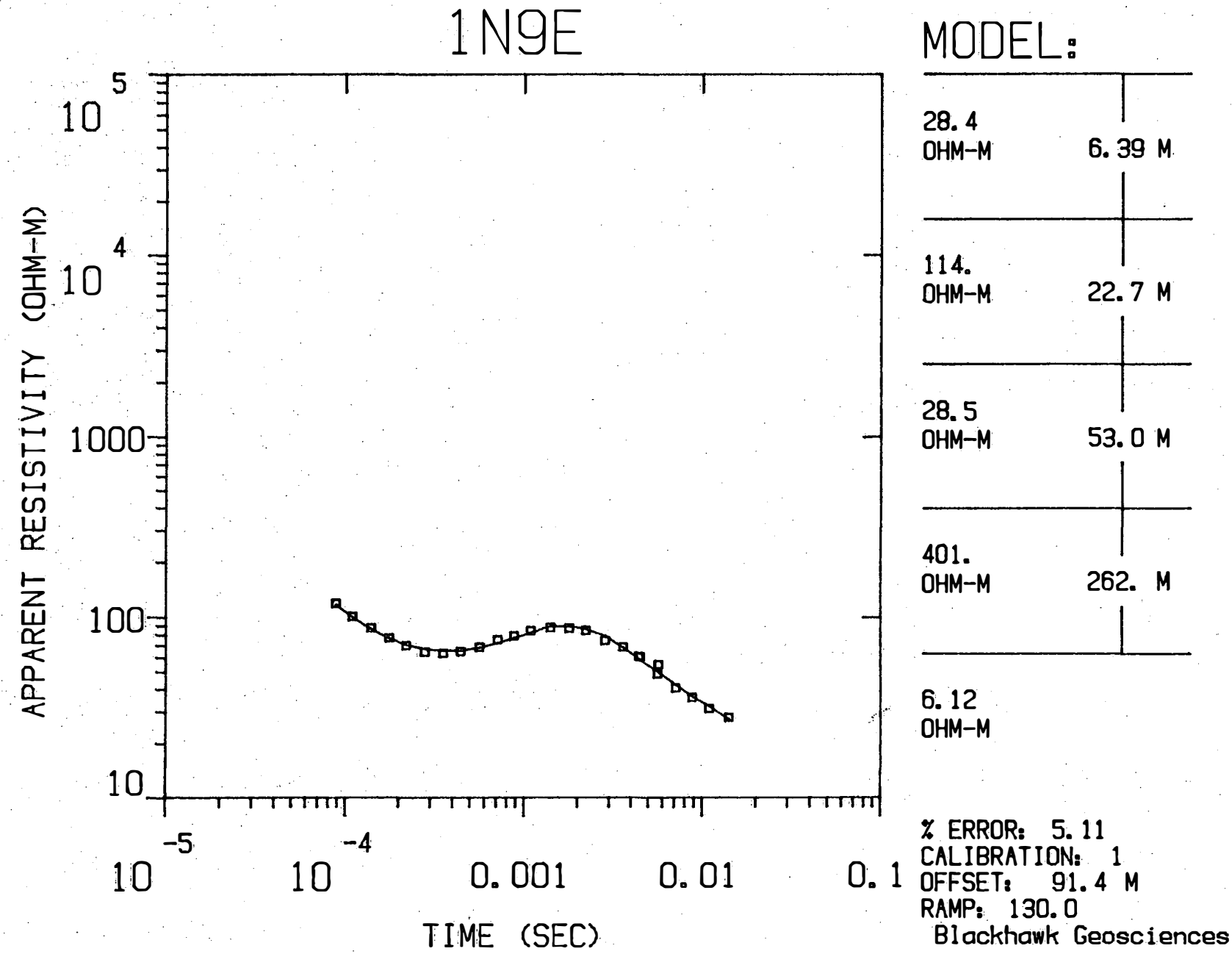
R: 147. X: 0. Y: 147. DL: 295. REQ: 163. CF: 1.0000
TDHZ ARRAY, 27 DATA POINTS, RAMP: 190.0 MICROSEC, DATA: 1N4E
1403 001N 0004 Z OPR XTL L 5 10+1000
Ch.21 = 0.19 Ch.22 = 0.89 Ch.23 = 19.5 Ch.24 =
RMS LOG ERROR: 1.67E-02, ANTILOG YIELDS 3.9301 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Inc. *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

| | | | | | |
|---|---|---|---|---|---|
| P 1 | 0.63 | | | | |
| P 2 | -0.02 | 0.42 | | | |
| P 3 | -0.08 | 0.19 | 0.20 | | |
| P 4 | 0.00 | 0.01 | -0.03 | 0.97 | |
| T 1 | -0.43 | -0.21 | -0.04 | 0.00 | 0.44 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| T 2 | -0.04 | 0.17 | 0.17 | -0.01 | 0.60 | 0.81 | |
| T 3 | 0.12 | -0.24 | -0.20 | 0.02 | 0.08 | 0.29 | 0.53 |
| | P 1 | P 2 | P 3 | P 4 | T 1 | T 2 | T 3 |


1N9E
APPARENT RESISTIVITY (OHM-M)
10^5
10^4
1000
100
10
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
MODEL:
28.4
OHM-M
6.39 M
114.
OHM-M
22.7 M
28.5
OHM-M
53.0 M
401.
OHM-M
262. M
6.12
OHM-M
% ERROR: 5.11
CALIBRATION: 1
OFFSET: 91.4 M
RAMP: 130.0
Blackhawk Geosciences

MODEL: 5 LAYERS

| RESISTIVITY (OHM-M) | THICKNESS (M) | ELEVATION (M) | ELEVATION (FEET) | CONDUCTANCE (S) LAYER | CONDUCTANCE (S) TOTAL |
|---|---|---|---|---|---|
| | | 103.6 | 340.0 | | |
| 28.43 | 6.4 | 97.2 | 319.0 | 0.2 | 0.2 |
| 114.45 | 22.7 | 74.5 | 244.4 | 0.2 | 0.4 |
| 28.53 | 53.0 | 21.5 | 70.4 | 1.9 | 2.3 |
| 401.00 | 262.5 | -241.0 | -790.8 | 0.7 | 2.9 |
| 6.12 | | | | | |

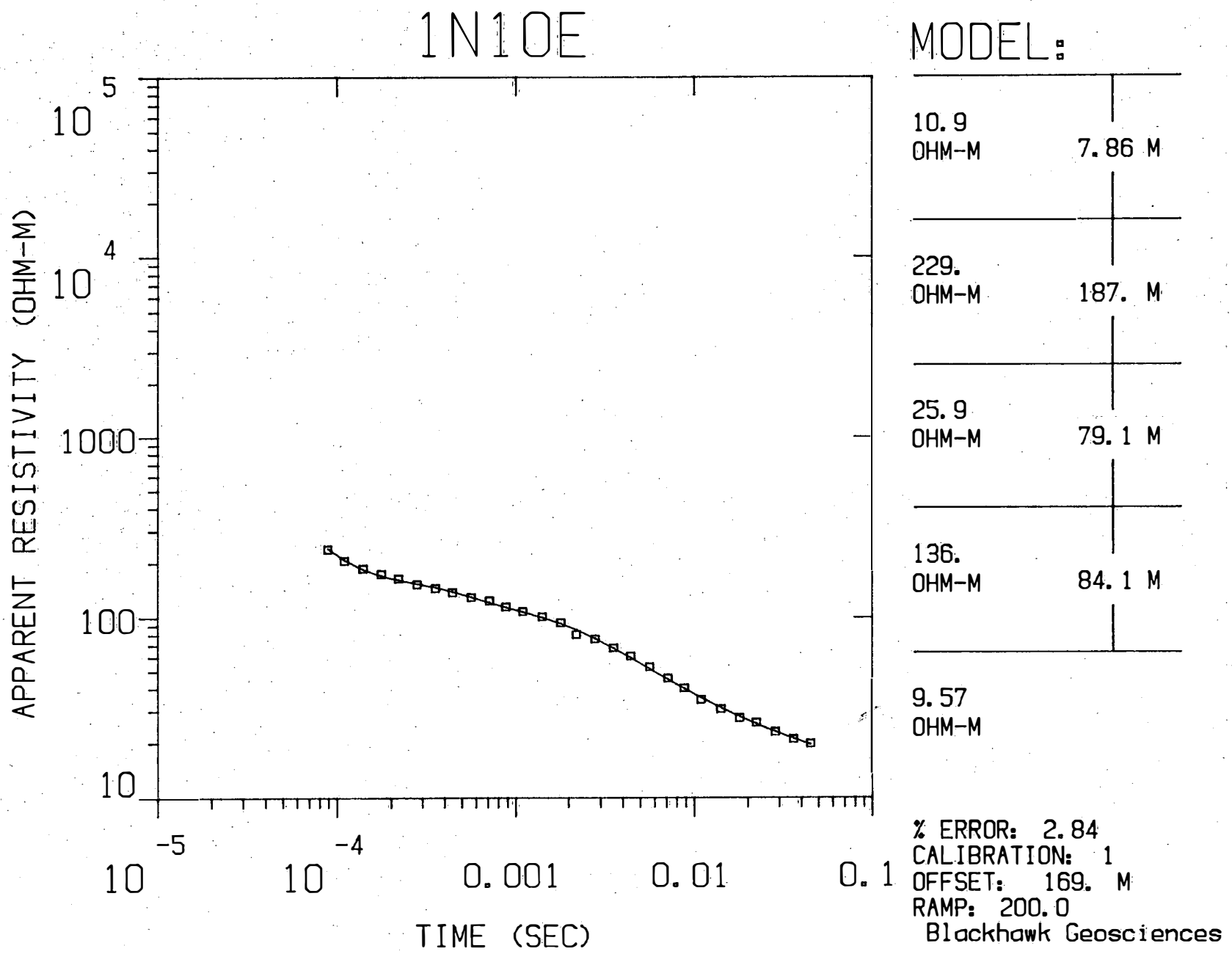
| | TIMES | DATA | CALC | % ERROR | STD ERR |
|---|---|---|---|---|---|
| 1 | 8.90E-05 | 1.19E+02 | 1.18E+02 | 1.203 | |
| 2 | 1.10E-04 | 1.01E+02 | 1.01E+02 | 0.522 | |
| 3 | 1.40E-04 | 8.75E+01 | 8.65E+01 | 1.159 | |
| 4 | 1.77E-04 | 7.69E+01 | 7.68E+01 | 0.191 | |
| 5 | 2.20E-04 | 7.00E+01 | 7.09E+01 | -1.369 | |
| 6 | 2.80E-04 | 6.44E+01 | 6.71E+01 | -4.063 | |
| 7 | 3.55E-04 | 6.34E+01 | 6.54E+01 | -3.137 | |
| 8 | 4.43E-04 | 6.48E+01 | 6.56E+01 | -1.175 | |
| 9 | 5.64E-04 | 6.86E+01 | 6.80E+01 | 0.959 | |
| 10 | 7.13E-04 | 7.55E+01 | 7.23E+01 | 4.349 | |
| 11 | 8.81E-04 | 7.92E+01 | 7.70E+01 | 2.840 | |
| 12 | 1.10E-03 | 8.47E+01 | 8.25E+01 | 2.662 | |
| 13 | 1.41E-03 | 8.81E+01 | 8.98E+01 | -1.896 | |
| 14 | 1.80E-03 | 8.73E+01 | 8.96E+01 | -2.653 | |
| 15 | 2.22E-03 | 8.47E+01 | 8.64E+01 | -1.962 | |
| 16 | 2.85E-03 | 7.45E+01 | 7.93E+01 | -6.122 | |
| 17 | 3.60E-03 | 6.85E+01 | 6.83E+01 | 0.400 | |
| 18 | 4.43E-03 | 6.09E+01 | 5.90E+01 | 3.103 | |
| 19 | 4.49E-03 | 6.07E+01 | 5.85E+01 | 3.773 | |
| 20 | 5.64E-03 | 4.88E+01 | 5.05E+01 | -3.251 | |
| 21 | 5.70E-03 | 5.49E+01 | 5.01E+01 | 9.597 | |
| 22 | 7.13E-03 | 4.08E+01 | 4.25E+01 | -4.009 | |
| 23 | 8.81E-03 | 3.62E+01 | 3.66E+01 | -1.286 | |
| 24 | 1.10E-02 | 3.13E+01 | 3.24E+01 | -3.251 | |
| 25 | 1.41E-02 | 2.80E+01 | 2.73E+01 | 2.460 | |

R: 91. X: 0. Y: 91. DL: 183. REQ: 101. CF: 1.0000
TDHZ ARRAY, 25 DATA POINTS, RAMP: 130.0 MICROSEC, DATA: 1N9E
2103 001N 009E Z OPR XTL L 3 10+1000
Ch.21 = 0.13 Ch.22 = 0.89 Ch.23 = 20 Ch.24 = 33
RMS LOG ERROR: 2.16E-02, ANTILOG YIELDS 5.1063 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Inc. *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| P 1 | 0.85 | | | | | | | |
| P 2 | 0.01 | 0.08 | | | | | | |
| P 3 | 0.03 | 0.09 | 0.82 | | | | | |
| P 4 | 0.00 | 0.03 | -0.05 | 0.08 | | | | |
| P 5 | -0.02 | 0.00 | 0.04 | -0.04 | 0.90 | | | |
| T 1 | 0.00 | -0.05 | -0.04 | -0.04 | 0.00 | 0.04 | | |
| T 2 | 0.03 | 0.19 | 0.18 | 0.01 | -0.04 | -0.08 | 0.63 | |
| T 3 | 0.02 | 0.00 | -0.21 | -0.15 | 0.05 | 0.07 | 0.27 | 0.71 |
| T 4 | 0.00 | -0.01 | 0.02 | 0.05 | 0.01 | 0.02 | -0.01 | 0.02 | 0.99 |




MODEL:

| | |
|---|---|
| 10.9 OHM-M | 7.86 M |
| 229. OHM-M | 187. M |
| 25.9 OHM-M | 79.1 M |
| 136. OHM-M | 84.1 M |
| 9.57 OHM-M | |

% ERROR: 2.84
CALIBRATION: 1
OFFSET: 169. M
RAMP: 200.0
Blackhawk Geosciences

1N10E

MODEL: 5 LAYERS

| RESISTIVITY (OHM-M) | THICKNESS (M) | ELEVATION (M) | ELEVATION (FEET) | CONDUCTANCE (S) LAYER | CONDUCTANCE (S) TOTAL |
|---|---|---|---|---|---|
| | | 155.4 | 510.0 | | |
| 10.93 | 7.9 | 147.6 | 484.2 | 0.7 | 0.7 |
| 228.68 | 187.1 | -39.5 | -129.5 | 0.8 | 1.5 |
| 25.93 | 79.1 | -118.6 | -389.0 | 3.0 | 4.6 |
| 136.05 | 84.1 | -202.6 | -664.8 | 0.6 | 5.2 |
| 9.57 | | | | | |

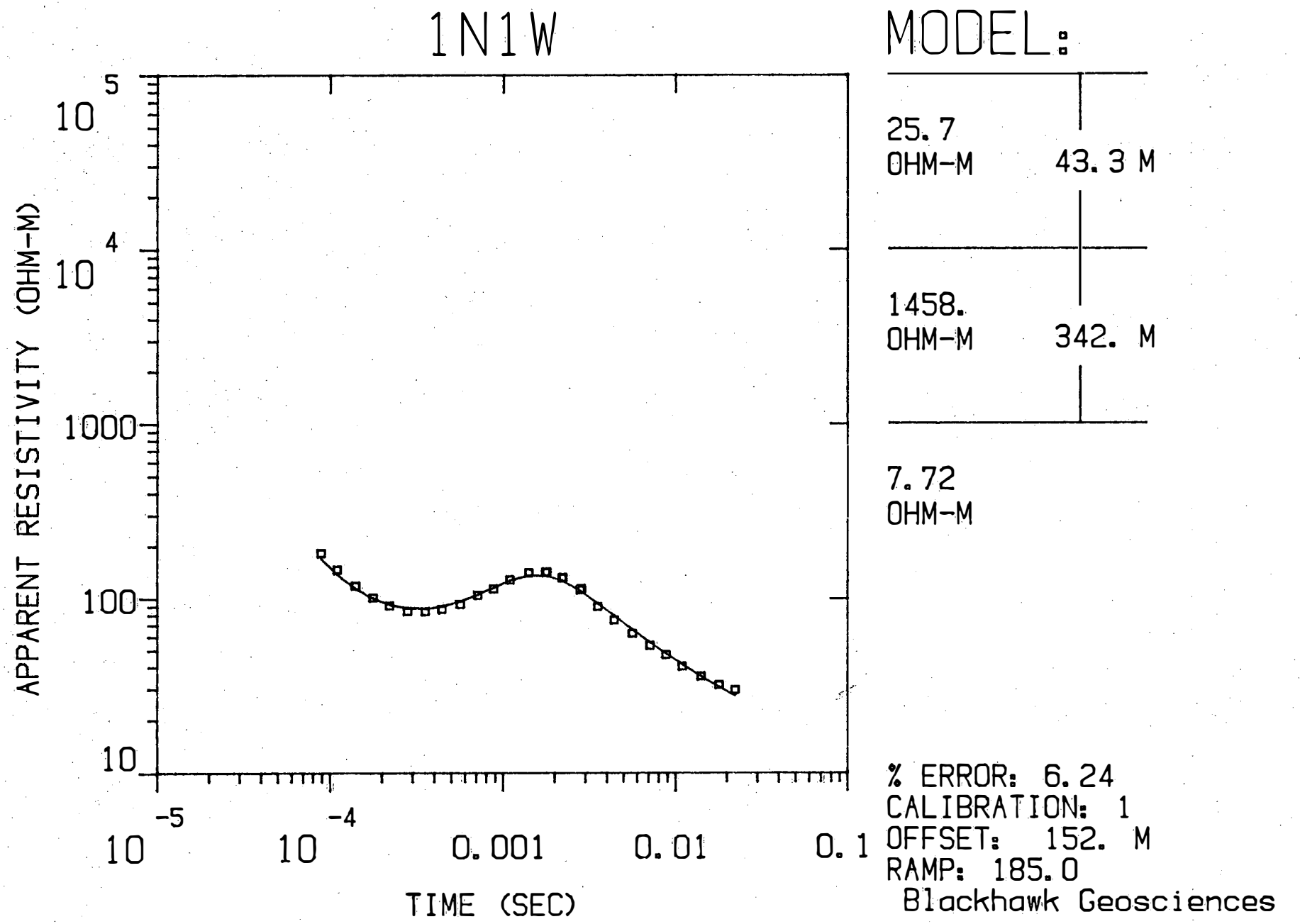
| | TIMES | DATA | CALC | % ERROR | STD ERR |
|---|---|---|---|---|---|
| 1 | 8.90E-05 | 2.37E+02 | 2.42E+02 | -1.752 | |
| 2 | 1.10E-04 | 2.06E+02 | 2.09E+02 | -1.359 | |
| 3 | 1.40E-04 | 1.86E+02 | 1.85E+02 | 0.884 | |
| 4 | 1.77E-04 | 1.74E+02 | 1.70E+02 | 2.245 | |
| 5 | 2.20E-04 | 1.64E+02 | 1.61E+02 | 1.788 | |
| 6 | 2.80E-04 | 1.53E+02 | 1.54E+02 | -0.954 | |
| 7 | 3.55E-04 | 1.45E+02 | 1.47E+02 | -1.174 | |
| 8 | 4.43E-04 | 1.38E+02 | 1.39E+02 | -1.288 | |
| 9 | 5.64E-04 | 1.29E+02 | 1.30E+02 | -0.645 | |
| 10 | 7.13E-04 | 1.24E+02 | 1.21E+02 | 2.226 | |
| 11 | 8.81E-04 | 1.15E+02 | 1.14E+02 | 0.608 | |
| 12 | 1.10E-03 | 1.08E+02 | 1.07E+02 | 0.737 | |
| 13 | 1.41E-03 | 1.01E+02 | 1.00E+02 | 1.203 | |
| 14 | 1.80E-03 | 9.35E+01 | 9.25E+01 | 1.097 | |
| 15 | 2.20E-03 | 8.02E+01 | 8.53E+01 | -6.006 | |
| 16 | 2.80E-03 | 7.57E+01 | 7.62E+01 | -0.662 | |
| 17 | 3.55E-03 | 6.74E+01 | 6.72E+01 | 0.346 | |
| 18 | 4.43E-03 | 6.05E+01 | 5.92E+01 | 2.272 | |
| 19 | 5.64E-03 | 5.27E+01 | 5.14E+01 | 2.659 | |
| 20 | 7.13E-03 | 4.55E+01 | 4.49E+01 | 1.455 | |
| 21 | 8.81E-03 | 4.01E+01 | 3.99E+01 | 0.692 | |
| 22 | 1.10E-02 | 3.46E+01 | 3.55E+01 | -2.554 | |
| 23 | 1.41E-02 | 3.07E+01 | 3.12E+01 | -1.738 | |
| 24 | 1.80E-02 | 2.73E+01 | 2.79E+01 | -1.920 | |
| 25 | 2.22E-02 | 2.58E+01 | 2.54E+01 | 1.694 | |
| 26 | 2.85E-02 | 2.29E+01 | 2.29E+01 | -0.247 | |
| 27 | 3.60E-02 | 2.09E+01 | 2.10E+01 | -0.503 | |
| 28 | 4.49E-02 | 1.97E+01 | 1.95E+01 | 1.087 | |

R: 169. X: 0. Y: 169. DL: 337. REQ: 188. CF: 1.0000
TDHZ ARRAY, 28 DATA POINTS, RAMP: 200.0 MICROSEC, DATA: 1N10E
1703 001N 0009 Z OPR XTL H 2 8+100
Ch.21 = 0.2 Ch.22 = 0.089 Ch.23 = 18 Ch.24 = 11
RMS LOG ERROR: 1.22E-02, ANTILOG YIELDS 2.8441 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Inc. *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER
P 1 0.67
P 2 -0.04 0.33
P 3 0.08 -0.09 0.58

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| P 5 | 0.01 | -0.01 | -0.01 | 0.00 | 0.98 | | | | |
| T 1 | -0.37 | -0.26 | 0.07 | 0.00 | 0.01 | 0.51 | | | |
| T 2 | -0.03 | 0.15 | 0.13 | 0.00 | 0.01 | 0.01 | 0.93 | | |
| T 3 | 0.00 | -0.05 | -0.39 | -0.02 | 0.03 | -0.01 | 0.08 | 0.44 | |
| T 4 | 0.06 | -0.18 | 0.09 | 0.08 | 0.00 | 0.01 | 0.04 | 0.24 | 0.76 |
| | P 1 | P 2 | P 3 | P 4 | P 5 | T 1 | T 2 | T 3 | T 4 |


1N1W
APPARENT RESISTIVITY (OHM-M)
10^5
10^4
1000
100
10
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
MODEL:
25.7
OHM-M
43.3 M
1458.
OHM-M
342. M
7.72
OHM-M
% ERROR: 6.24
CALIBRATION: 1
OFFSET: 152. M
RAMP: 185.0
Blackhawk Geosciences

1N1W

MODEL: 3 LAYERS

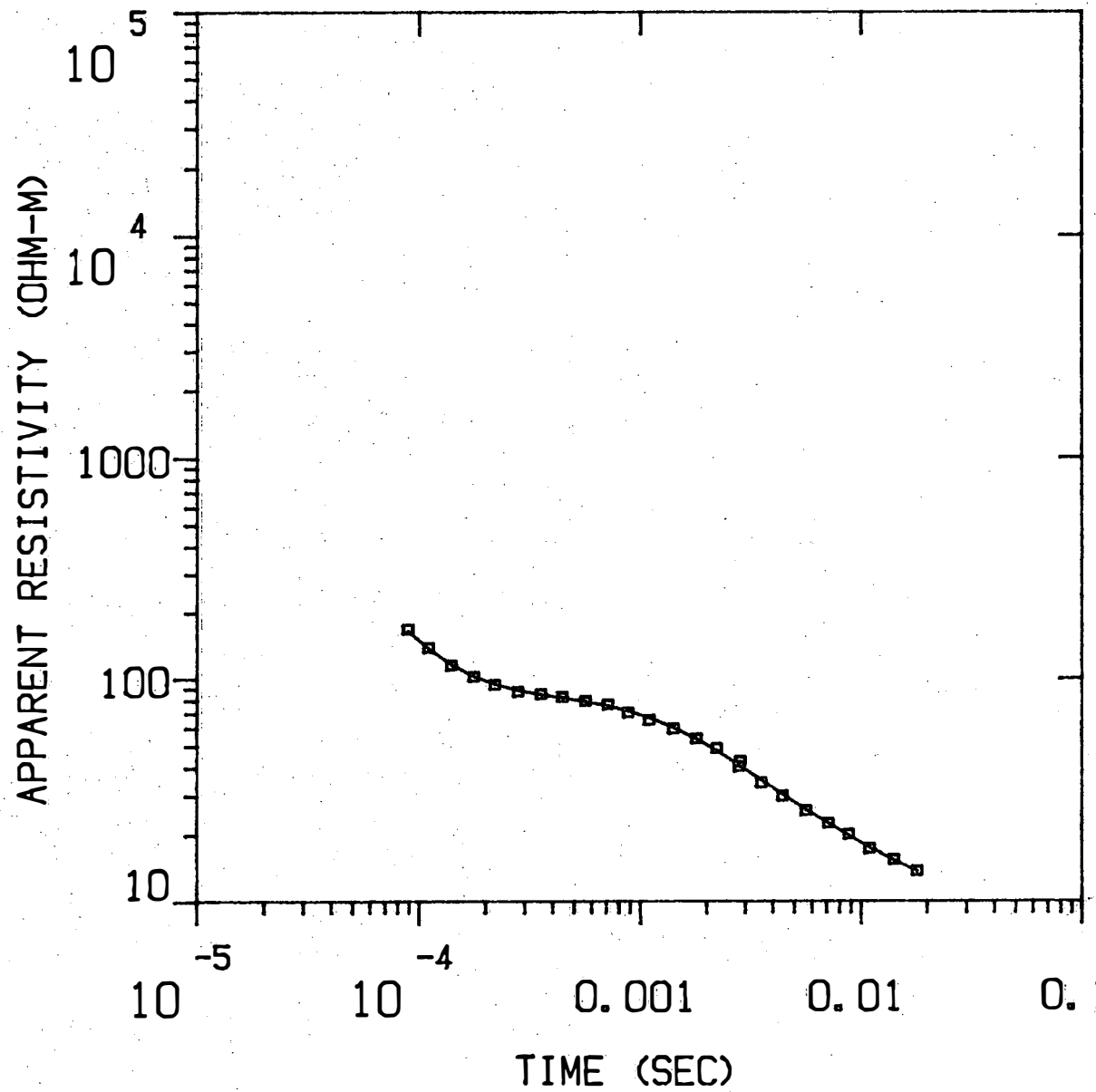
| RESISTIVITY (OHM-M) | THICKNESS (M) | ELEVATION (M) | ELEVATION (FEET) | CONDUCTANCE (S) LAYER | CONDUCTANCE (S) TOTAL |
|---|---|---|---|---|---|
| | | 167.6 | 550.0 | | |
| 25.72 | 43.3 | 124.3 | 407.8 | 1.7 | 1.7 |
| 1457.73 | 342.4 | -218.1 | -715.4 | 0.2 | 1.9 |
| 7.72 | | | | | |

| | TIMES | DATA | CALC | % ERROR | STD ERR |
|---|---|---|---|---|---|
| 1 | 8.90E-05 | 1.82E+02 | 1.70E+02 | 7.375 | |
| 2 | 1.10E-04 | 1.47E+02 | 1.38E+02 | 6.185 | |
| 3 | 1.40E-04 | 1.19E+02 | 1.15E+02 | 3.484 | |
| 4 | 1.77E-04 | 1.01E+02 | 1.00E+02 | 0.822 | |
| 5 | 2.20E-04 | 9.11E+01 | 9.24E+01 | -1.401 | |
| 6 | 2.80E-04 | 8.44E+01 | 8.81E+01 | -4.208 | |
| 7 | 3.55E-04 | 8.41E+01 | 8.76E+01 | -3.983 | |
| 8 | 4.43E-04 | 8.68E+01 | 9.03E+01 | -3.843 | |
| 9 | 5.64E-04 | 9.29E+01 | 9.65E+01 | -3.732 | |
| 10 | 7.13E-04 | 1.05E+02 | 1.06E+02 | -0.700 | |
| 11 | 8.81E-04 | 1.14E+02 | 1.16E+02 | -1.606 | |
| 12 | 1.10E-03 | 1.29E+02 | 1.27E+02 | 1.216 | |
| 13 | 1.41E-03 | 1.41E+02 | 1.37E+02 | 3.451 | |
| 14 | 1.77E-03 | 1.42E+02 | 1.36E+02 | 4.242 | |
| 15 | 1.80E-03 | 1.43E+02 | 1.36E+02 | 4.903 | |
| 16 | 2.20E-03 | 1.32E+02 | 1.27E+02 | 3.510 | |
| 17 | 2.22E-03 | 1.33E+02 | 1.27E+02 | 4.708 | |
| 18 | 2.80E-03 | 1.12E+02 | 1.11E+02 | 1.148 | |
| 19 | 2.85E-03 | 1.14E+02 | 1.10E+02 | 4.151 | |
| 20 | 3.55E-03 | 8.98E+01 | 9.40E+01 | -4.426 | |
| 21 | 4.43E-03 | 7.50E+01 | 7.95E+01 | -5.634 | |
| 22 | 5.64E-03 | 6.28E+01 | 6.63E+01 | -5.276 | |
| 23 | 7.13E-03 | 5.33E+01 | 5.58E+01 | -4.456 | |
| 24 | 8.81E-03 | 4.72E+01 | 4.81E+01 | -1.878 | |
| 25 | 1.10E-02 | 4.05E+01 | 4.16E+01 | -2.701 | |
| 26 | 1.41E-02 | 3.55E+01 | 3.55E+01 | 0.035 | |
| 27 | 1.80E-02 | 3.16E+01 | 3.08E+01 | 2.642 | |
| 28 | 2.22E-02 | 2.96E+01 | 2.74E+01 | 8.089 | |

R: 152. X: 0. Y: 152. DL: 305. REQ: 169. CF: 1.0000
TDHZ ARRAY, 28 DATA POINTS, RAMP: 185.0 MICROSEC, DATA: 1N1W
1403 001N 001W Z OPR XTL H 2 8+100
Ch.21 = 0.185 Ch.22 = 0.089 Ch.23 = 19.5 Ch.24
RMS LOG ERROR: 2.63E-02, ANTILOG YIELDS 6.2382 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Inc. *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER
P 1 0.23
P 2 0.01 0.00
P 3 0.00 0.00 0.01
T 1 -0.18 -0.01 0.01 0.15
T 2 0.04 0.00 0.03 -0.02 0.26




MODEL:

28.7 OHM-M — 43.1 M

173. OHM-M — 117. M

15.3 OHM-M — 94.5 M

4.62 OHM-M

% ERROR: 2.62
CALIBRATION: 1
OFFSET: 142. M
RAMP: 190.0

Blackhawk Geosciences, Inc.

2N1W

MODEL: 4 LAYERS

| RESISTIVITY (OHM-M) | THICKNESS (M) | ELEVATION (M) | ELEVATION (FEET) | CONDUCTANCE (S) LAYER | CONDUCTANCE (S) TOTAL |
|---|---|---|---|---|---|
| | | 202.7 | 665.0 | | |
| 28.68 | 43.1 | 159.6 | 523.6 | 1.5 | 1.5 |
| 173.07 | 116.7 | 42.9 | 140.8 | 0.7 | 2.2 |
| 15.32 | 94.5 | -51.6 | -169.1 | 6.2 | 8.3 |
| 4.62 | | | | | |

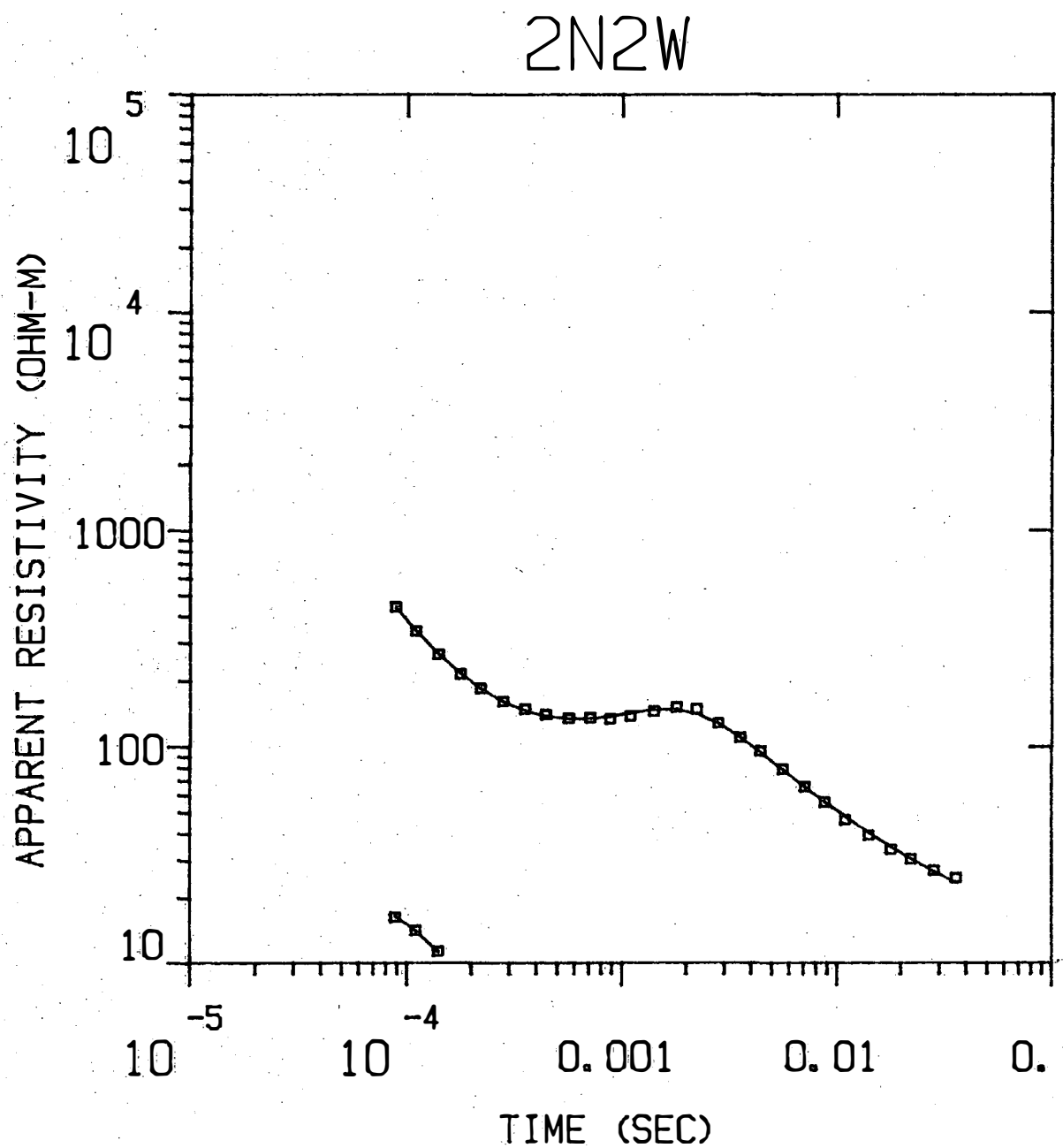
| | TIMES | DATA | CALC | % ERROR | STD ERR |
|---|---|---|---|---|---|
| 1 | 8.90E-05 | 1.68E+02 | 1.65E+02 | 1.734 | |
| 2 | 1.10E-04 | 1.38E+02 | 1.37E+02 | 0.875 | |
| 3 | 1.40E-04 | 1.15E+02 | 1.16E+02 | -0.722 | |
| 4 | 1.77E-04 | 1.02E+02 | 1.02E+02 | -0.582 | |
| 5 | 2.20E-04 | 9.38E+01 | 9.43E+01 | -0.544 | |
| 6 | 2.80E-04 | 8.72E+01 | 8.85E+01 | -1.433 | |
| 7 | 3.55E-04 | 8.50E+01 | 8.47E+01 | 0.404 | |
| 8 | 4.43E-04 | 8.27E+01 | 8.19E+01 | 0.989 | |
| 9 | 5.64E-04 | 7.93E+01 | 7.88E+01 | 0.627 | |
| 10 | 7.13E-04 | 7.63E+01 | 7.53E+01 | 1.350 | |
| 11 | 8.81E-04 | 7.03E+01 | 7.14E+01 | -1.606 | |
| 12 | 1.10E-03 | 6.51E+01 | 6.67E+01 | -2.391 | |
| 13 | 1.41E-03 | 5.95E+01 | 6.02E+01 | -1.246 | |
| 14 | 1.80E-03 | 5.37E+01 | 5.34E+01 | 0.463 | |
| 15 | 2.22E-03 | 4.87E+01 | 4.73E+01 | 2.975 | |
| 16 | 2.80E-03 | 4.03E+01 | 4.10E+01 | -1.535 | |
| 17 | 2.85E-03 | 4.27E+01 | 4.05E+01 | 5.415 | |
| 18 | 3.55E-03 | 3.42E+01 | 3.51E+01 | -2.635 | |
| 19 | 4.43E-03 | 2.98E+01 | 3.04E+01 | -1.726 | |
| 20 | 5.64E-03 | 2.57E+01 | 2.60E+01 | -1.220 | |
| 21 | 7.13E-03 | 2.25E+01 | 2.25E+01 | 0.066 | |
| 22 | 8.81E-03 | 2.01E+01 | 1.98E+01 | 1.254 | |
| 23 | 1.10E-02 | 1.74E+01 | 1.75E+01 | -0.916 | |
| 24 | 1.41E-02 | 1.55E+01 | 1.53E+01 | 0.764 | |
| 25 | 1.80E-02 | 1.37E+01 | 1.37E+01 | 0.497 | |

R: 142. X: 0. Y: 142. DL: 283. REQ: 158. CF: 1.0000
TDHZ ARRAY, 25 DATA POINTS, RAMP: 190.0 MICROSEC, DATA: 2N1W
1803 002N 001W Z OPR XTL L 4 10+1000
Ch.21 = 0.19 Ch.22 = 0.89 Ch.23 = 20 Ch.24 = 80
RMS LOG ERROR: 1.12E-02, ANTILOG YIELDS 2.6187 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Inc. *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| P 1 | 0.95 | | | | | | |
| P 2 | -0.03 | 0.11 | | | | | |
| P 3 | 0.08 | -0.04 | 0.35 | | | | |
| P 4 | 0.00 | 0.01 | -0.06 | 0.95 | | | |
| T 1 | -0.10 | -0.21 | 0.16 | 0.00 | 0.78 | | |
| T 2 | -0.01 | 0.16 | 0.22 | 0.01 | 0.00 | 0.90 | |
| T 3 | 0.05 | -0.10 | -0.16 | 0.03 | 0.08 | 0.07 | 0.88 |




MODEL:

64.8
OHM-M

108. M

248.
OHM-M

329. M

7.55
OHM-M

% ERROR: 3.17
CALIBRATION: 1
OFFSET: 233. M
RAMP: 220.0

Blackhawk Geosciences, Inc.

MODEL: 3 LAYERS

| RESISTIVITY (OHM-M) | THICKNESS (M) | ELEVATION (M) | ELEVATION (FEET) | CONDUCTANCE (S) LAYER | CONDUCTANCE (S) TOTAL |
|---|---|---|---|---|---|
| | | 237.7 | 780.0 | | |
| 64.85 | 108.3 | 129.5 | 424.8 | 1.7 | 1.7 |
| 248.40 | 329.5 | -200.0 | -656.2 | 1.3 | 3.0 |
| 7.55 | | | | | |

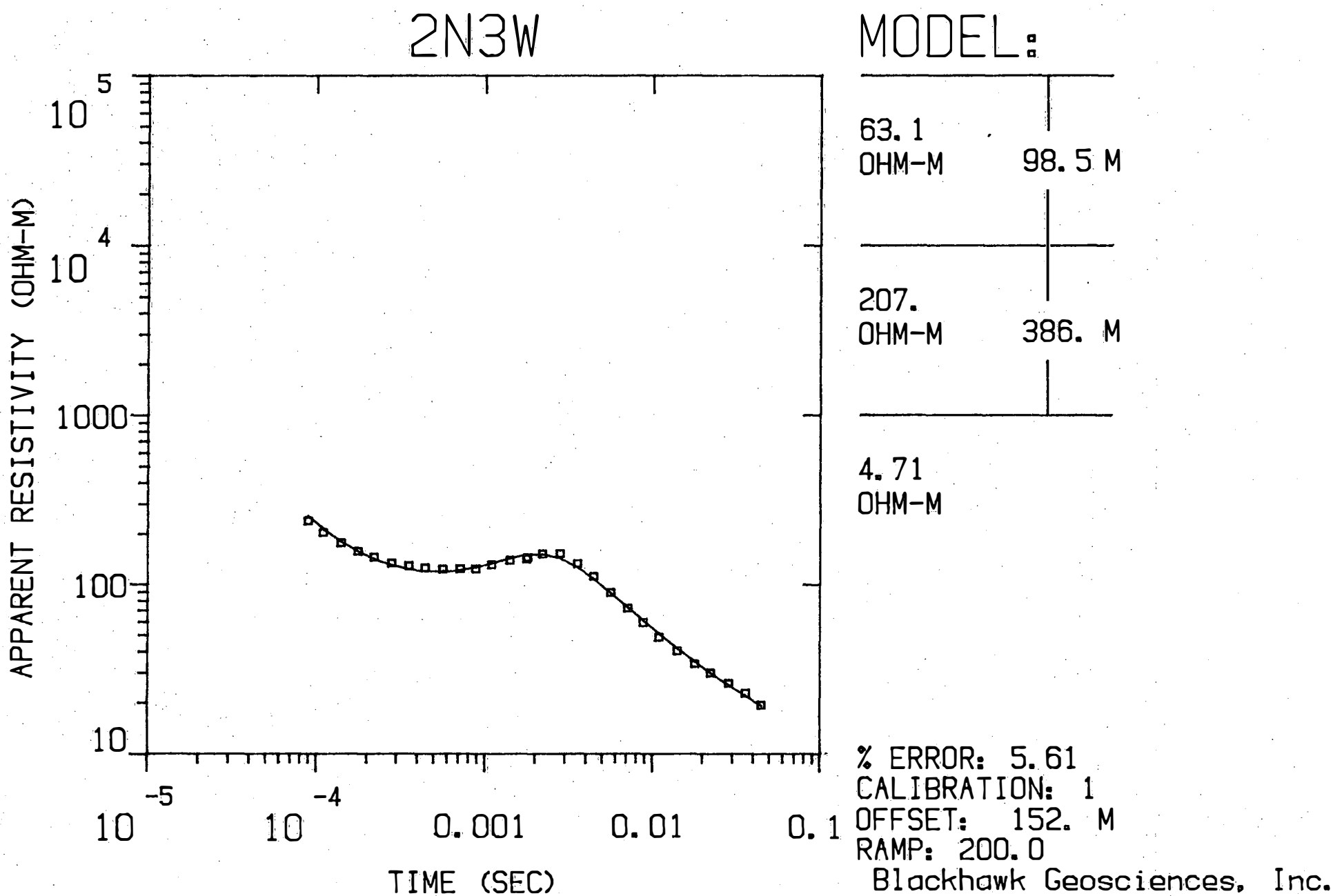
| | TIMES | DATA | CALC | % ERROR | STD ERR |
|---|---|---|---|---|---|
| 1 | 8.90E-05 | 4.42E+02 | 4.40E+02 | 0.567 | |
| 2 | 1.10E-04 | 3.41E+02 | 3.42E+02 | -0.286 | |
| 3 | 1.40E-04 | 2.65E+02 | 2.66E+02 | -0.488 | |
| 4 | 1.77E-04 | 2.15E+02 | 2.16E+02 | -0.731 | |
| 5 | 2.20E-04 | 1.85E+02 | 1.85E+02 | 0.118 | |
| 6 | 2.80E-04 | 1.61E+02 | 1.61E+02 | 0.146 | |
| 7 | 3.55E-04 | 1.48E+02 | 1.46E+02 | 1.689 | |
| 8 | 4.43E-04 | 1.40E+02 | 1.38E+02 | 1.803 | |
| 9 | 5.64E-04 | 1.34E+02 | 1.34E+02 | 0.499 | |
| 10 | 7.13E-04 | 1.35E+02 | 1.34E+02 | 0.713 | |
| 11 | 8.81E-04 | 1.34E+02 | 1.37E+02 | -2.786 | |
| 12 | 1.10E-03 | 1.38E+02 | 1.42E+02 | -3.343 | |
| 13 | 1.41E-03 | 1.45E+02 | 1.48E+02 | -1.621 | |
| 14 | 1.80E-03 | 1.51E+02 | 1.48E+02 | 2.305 | |
| 15 | 2.22E-03 | 1.48E+02 | 1.41E+02 | 5.017 | |
| 16 | 2.80E-03 | 1.28E+02 | 1.28E+02 | -0.213 | |
| 17 | 3.55E-03 | 1.10E+02 | 1.10E+02 | -0.423 | |
| 18 | 4.43E-03 | 9.53E+01 | 9.41E+01 | 1.251 | |
| 19 | 5.64E-03 | 7.89E+01 | 7.83E+01 | 0.707 | |
| 20 | 7.13E-03 | 6.56E+01 | 6.56E+01 | 0.002 | |
| 21 | 8.81E-03 | 5.58E+01 | 5.61E+01 | -0.532 | |
| 22 | 1.10E-02 | 4.63E+01 | 4.80E+01 | -3.519 | |
| 23 | 1.41E-02 | 3.94E+01 | 4.05E+01 | -2.779 | |
| 24 | 1.80E-02 | 3.38E+01 | 3.48E+01 | -2.802 | |
| 25 | 2.22E-02 | 3.05E+01 | 3.06E+01 | -0.334 | |
| 26 | 2.85E-02 | 2.70E+01 | 2.67E+01 | 1.264 | |
| 27 | 3.60E-02 | 2.49E+01 | 2.37E+01 | 5.096 | |

R: 233. X: 0. Y: 233. DL: 465. REQ: 259. CF: 1.0000
TDHZ ARRAY, 27 DATA POINTS, RAMP: 220.0 MICROSEC, DATA: 2N2W
1803 002N 002W Z OPR XTL L 4 10+1000
Ch.21 = 0.22 Ch.22 = 0.89 Ch.23 = 14 Ch.24 = 21
RMS LOG ERROR: 1.36E-02, ANTILOG YIELDS 3.1735 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Inc. *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

| | | | | | |
|---|---|---|---|---|---|
| P 1 | 1.00 | | | | |
| P 2 | 0.00 | 0.95 | | | |
| P 3 | 0.00 | 0.00 | 1.00 | | |
| T 1 | 0.00 | -0.02 | 0.00 | 0.99 | |
| T 2 | 0.00 | 0.01 | 0.00 | 0.00 | 1.00 |
| | P 1 | P 2 | P 3 | T 1 | T 2 |


2N3W
APPARENT RESISTIVITY (OHM-M)
10^5
10^4
1000
100
10
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
MODEL:
63.1
OHM-M
98.5 M
207.
OHM-M
386. M
4.71
OHM-M
% ERROR: 5.61
CALIBRATION: 1
OFFSET: 152. M
RAMP: 200.0
Blackhawk Geosciences, Inc.

MODEL: 3 LAYERS

| RESISTIVITY (OHM-M) | THICKNESS (M) | ELEVATION (M) | (FEET) | CONDUCTANCE (S) LAYER | TOTAL |
|---|---|---|---|---|---|
| | | 265.2 | 870.0 | | |
| 63.08 | 98.5 | 166.7 | 546.8 | 1.6 | 1.6 |
| 207.44 | 385.7 | -219.1 | -718.7 | 1.9 | 3.4 |
| 4.71 | | | | | |

| | TIMES | DATA | CALC | % ERROR | STD ERR |
|---|---|---|---|---|---|
| 1 | 8.90E-05 | 2.38E+02 | 2.55E+02 | -6.549 | |
| 2 | 1.10E-04 | 2.03E+02 | 2.13E+02 | -4.968 | |
| 3 | 1.40E-04 | 1.76E+02 | 1.80E+02 | -2.126 | |
| 4 | 1.77E-04 | 1.57E+02 | 1.57E+02 | 0.037 | |
| 5 | 2.20E-04 | 1.45E+02 | 1.41E+02 | 2.620 | |
| 6 | 2.80E-04 | 1.34E+02 | 1.30E+02 | 2.950 | |
| 7 | 3.55E-04 | 1.29E+02 | 1.23E+02 | 4.921 | |
| 8 | 4.43E-04 | 1.25E+02 | 1.19E+02 | 5.147 | |
| 9 | 5.64E-04 | 1.23E+02 | 1.19E+02 | 3.636 | |
| 10 | 7.13E-04 | 1.24E+02 | 1.21E+02 | 1.870 | |
| 11 | 8.81E-04 | 1.24E+02 | 1.26E+02 | -2.107 | |
| 12 | 1.10E-03 | 1.31E+02 | 1.33E+02 | -1.898 | |
| 13 | 1.41E-03 | 1.39E+02 | 1.43E+02 | -2.765 | |
| 14 | 1.77E-03 | 1.41E+02 | 1.50E+02 | -5.926 | |
| 15 | 1.80E-03 | 1.44E+02 | 1.51E+02 | -4.226 | |
| 16 | 2.20E-03 | 1.52E+02 | 1.52E+02 | 0.367 | |
| 17 | 2.80E-03 | 1.52E+02 | 1.43E+02 | 6.507 | |
| 18 | 3.55E-03 | 1.33E+02 | 1.27E+02 | 5.064 | |
| 19 | 4.43E-03 | 1.12E+02 | 1.08E+02 | 3.292 | |
| 20 | 5.64E-03 | 8.95E+01 | 8.89E+01 | 0.632 | |
| 21 | 7.13E-03 | 7.22E+01 | 7.30E+01 | -1.197 | |
| 22 | 8.81E-03 | 5.94E+01 | 6.12E+01 | -2.897 | |
| 23 | 1.10E-02 | 4.85E+01 | 5.12E+01 | -5.133 | |
| 24 | 1.41E-02 | 4.03E+01 | 4.19E+01 | -3.794 | |
| 25 | 1.80E-02 | 3.39E+01 | 3.50E+01 | -3.054 | |
| 26 | 2.22E-02 | 2.99E+01 | 3.00E+01 | -0.163 | |
| 27 | 2.85E-02 | 2.60E+01 | 2.54E+01 | 2.323 | |
| 28 | 3.60E-02 | 2.27E+01 | 2.19E+01 | 3.607 | |
| 29 | 4.49E-02 | 1.94E+01 | 1.92E+01 | 0.962 | |

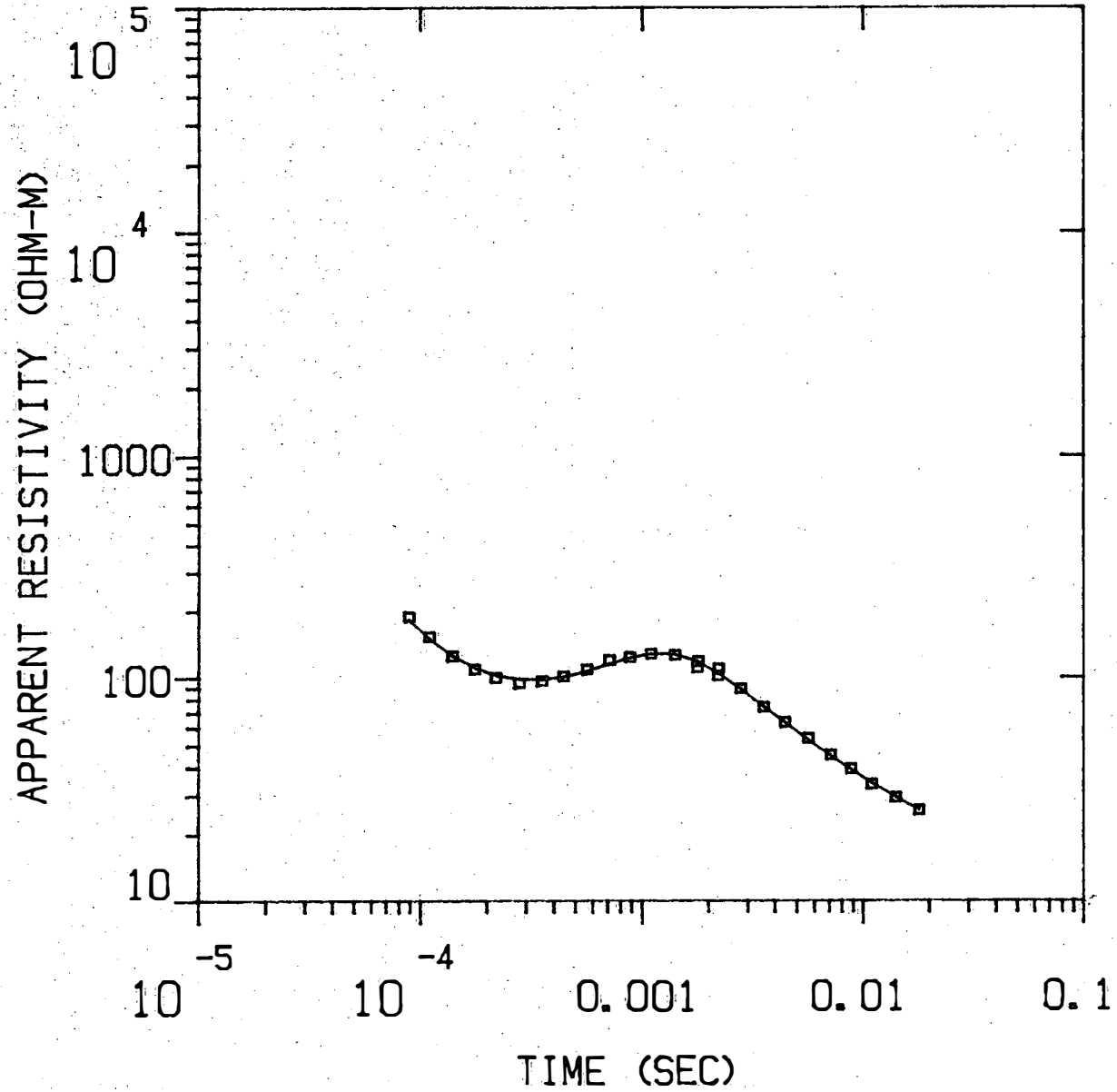
R: 152. X: 0. Y: 152. DL: 305. REQ: 169. CF: 1.0000
TDHZ ARRAY, 29 DATA POINTS, RAMP: 200.0 MICROSEC, DATA: 2N3W
1803 002N 003W Z OPR XTL L 5 10+1000
Ch.21 = 0.2 Ch.22 = 0.89 Ch.23 = 19 Ch.24 = 929
RMS LOG ERROR: 2.37E-02, ANTILOG YIELDS 5.6135 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Inc. *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

| | | | | | |
|---|---|---|---|---|---|
| P 1 | 0.84 | | | | |
| P 2 | 0.05 | 0.20 | | | |
| P 3 | 0.01 | -0.06 | 0.32 | | |
| T 1 | -0.22 | -0.22 | 0.05 | 0.40 | |
| T 2 | 0.05 | 0.09 | 0.05 | 0.14 | 0.91 |
| | P 1 | P 2 | P 3 | T 1 | T 2 |

# 2N4W




## MODEL:

28.1
OHM-M

44.4 M

788.
OHM-M

287. M

7.49
OHM-M

% ERROR: 3.60
CALIBRATION: 1
OFFSET: 152. M
RAMP: 200.0

Blackhawk Geosciences, Inc.

MODEL: 3 LAYERS

| RESISTIVITY (OHM-M) | THICKNESS (M) | ELEVATION (M) | ELEVATION (FEET) | CONDUCTANCE (S) LAYER | CONDUCTANCE (S) TOTAL |
|---|---|---|---|---|---|
| | | 213.4 | 700.0 | | |
| 28.09 | 44.4 | 169.0 | 554.3 | 1.6 | 1.6 |
| 788.25 | 287.1 | -118.2 | -387.7 | 0.4 | 1.9 |
| 7.49 | | | | | |

| | TIMES | DATA | CALC | % ERROR | STD ERR |
|---|---|---|---|---|---|
| 1 | 8.90E-05 | 1.89E+02 | 1.82E+02 | 3.594 | |
| 2 | 1.10E-04 | 1.53E+02 | 1.50E+02 | 2.129 | |
| 3 | 1.40E-04 | 1.25E+02 | 1.25E+02 | -0.339 | |
| 4 | 1.77E-04 | 1.09E+02 | 1.11E+02 | -1.474 | |
| 5 | 2.20E-04 | 9.97E+01 | 1.02E+02 | -2.595 | |
| 6 | 2.80E-04 | 9.43E+01 | 9.80E+01 | -3.776 | |
| 7 | 3.55E-04 | 9.66E+01 | 9.77E+01 | -1.149 | |
| 8 | 4.43E-04 | 1.01E+02 | 1.01E+02 | 0.673 | |
| 9 | 5.64E-04 | 1.09E+02 | 1.07E+02 | 1.943 | |
| 10 | 7.13E-04 | 1.20E+02 | 1.15E+02 | 4.177 | |
| 11 | 8.81E-04 | 1.24E+02 | 1.23E+02 | 0.425 | |
| 12 | 1.10E-03 | 1.28E+02 | 1.29E+02 | -0.320 | |
| 13 | 1.41E-03 | 1.26E+02 | 1.27E+02 | -0.662 | |
| 14 | 1.77E-03 | 1.11E+02 | 1.18E+02 | -5.876 | |
| 15 | 1.80E-03 | 1.19E+02 | 1.17E+02 | 1.179 | |
| 16 | 2.20E-03 | 1.02E+02 | 1.04E+02 | -2.651 | |
| 17 | 2.22E-03 | 1.09E+02 | 1.04E+02 | 5.453 | |
| 18 | 2.80E-03 | 8.90E+01 | 8.85E+01 | 0.643 | |
| 19 | 3.55E-03 | 7.36E+01 | 7.41E+01 | -0.727 | |
| 20 | 4.43E-03 | 6.29E+01 | 6.28E+01 | 0.088 | |
| 21 | 5.64E-03 | 5.36E+01 | 5.27E+01 | 1.697 | |
| 22 | 7.13E-03 | 4.52E+01 | 4.48E+01 | 0.878 | |
| 23 | 8.81E-03 | 3.92E+01 | 3.90E+01 | 0.697 | |
| 24 | 1.10E-02 | 3.35E+01 | 3.40E+01 | -1.451 | |
| 25 | 1.41E-02 | 2.93E+01 | 2.94E+01 | -0.269 | |
| 26 | 1.80E-02 | 2.57E+01 | 2.58E+01 | -0.398 | |

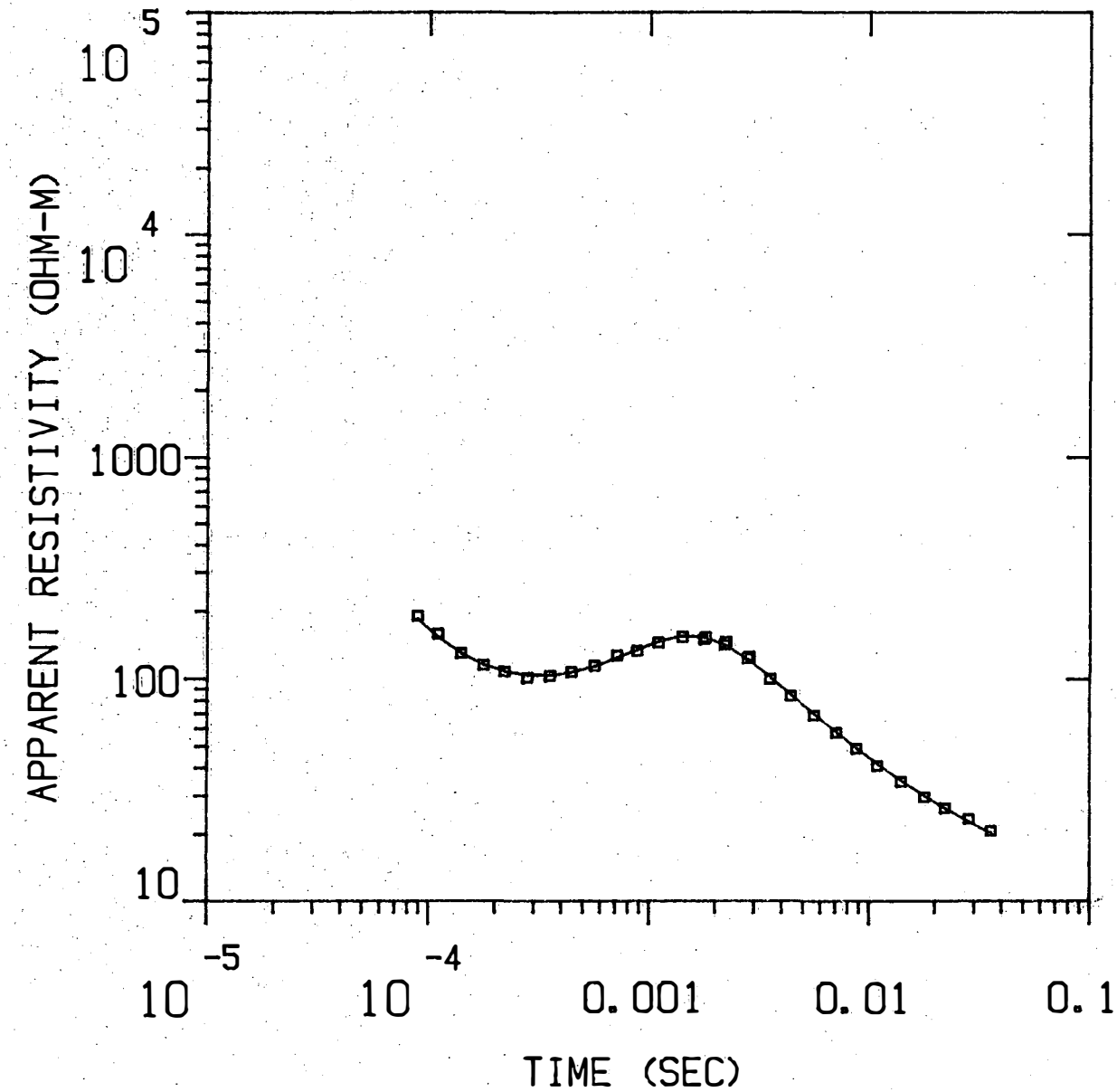
R: 152. X: 0. Y: 152. DL: 305. REQ: 169. CF: 1.0000
TDHZ ARRAY, 26 DATA POINTS, RAMP: 200.0 MICROSEC, DATA: 2N4W
1903 002N 004W Z OPR XTL L 4 10+1000
Ch.21 = 0.2 Ch.22 = 0.89 Ch.23 = 19.5 Ch.24 = 9
RMS LOG ERROR: 1.54E-02, ANTILOG YIELDS 3.6030 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Inc. *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

| | | | | | |
|---|---|---|---|---|---|
| P 1 | 0.96 | | | | |
| P 2 | -0.04 | 0.03 | | | |
| P 3 | 0.02 | -0.02 | 0.93 | | |
| T 1 | -0.06 | -0.11 | 0.03 | 0.92 | |
| T 2 | 0.00 | 0.03 | 0.01 | 0.01 | 1.00 |
| | P 1 | P 2 | P 3 | T 1 | T 2 |

# 2N5W




## MODEL:

27.3
OHM-M

38.4 M

472.
OHM-M

368. M

6.11
OHM-M

% ERROR: 2.90
CALIBRATION: 1
OFFSET: 152. M
RAMP: 200.0

Blackhawk Geosciences, Inc.

2N5W

MODEL: 3 LAYERS

| RESISTIVITY (OHM-M) | THICKNESS (M) | ELEVATION (M) | ELEVATION (FEET) | CONDUCTANCE (S) LAYER | CONDUCTANCE (S) TOTAL |
|---|---|---|---|---|---|
| | | 210.3 | 690.0 | | |
| 27.33 | 38.4 | 171.9 | 563.9 | 1.4 | 1.4 |
| 471.70 | 368.3 | -196.4 | -644.4 | 0.8 | 2.2 |
| 6.11 | | | | | |

| | TIMES | DATA | CALC | % ERROR | STD ERR |
|---|---|---|---|---|---|
| 1 | 8.90E-05 | 1.91E+02 | 1.85E+02 | 3.441 | |
| 2 | 1.10E-04 | 1.58E+02 | 1.54E+02 | 3.158 | |
| 3 | 1.40E-04 | 1.30E+02 | 1.30E+02 | -0.116 | |
| 4 | 1.77E-04 | 1.15E+02 | 1.16E+02 | -0.663 | |
| 5 | 2.20E-04 | 1.08E+02 | 1.08E+02 | -0.164 | |
| 6 | 2.80E-04 | 1.01E+02 | 1.04E+02 | -2.842 | |
| 7 | 3.55E-04 | 1.03E+02 | 1.04E+02 | -0.787 | |
| 8 | 4.43E-04 | 1.07E+02 | 1.07E+02 | 0.216 | |
| 9 | 5.64E-04 | 1.15E+02 | 1.14E+02 | 0.472 | |
| 10 | 7.13E-04 | 1.27E+02 | 1.24E+02 | 2.533 | |
| 11 | 8.81E-04 | 1.34E+02 | 1.35E+02 | -1.149 | |
| 12 | 1.10E-03 | 1.45E+02 | 1.47E+02 | -1.068 | |
| 13 | 1.41E-03 | 1.54E+02 | 1.56E+02 | -0.869 | |
| 14 | 1.77E-03 | 1.50E+02 | 1.53E+02 | -2.339 | |
| 15 | 1.80E-03 | 1.53E+02 | 1.53E+02 | 0.065 | |
| 16 | 2.20E-03 | 1.42E+02 | 1.42E+02 | 0.012 | |
| 17 | 2.22E-03 | 1.46E+02 | 1.41E+02 | 3.625 | |
| 18 | 2.80E-03 | 1.23E+02 | 1.22E+02 | 1.126 | |
| 19 | 2.85E-03 | 1.25E+02 | 1.21E+02 | 3.894 | |
| 20 | 3.55E-03 | 9.99E+01 | 1.02E+02 | -1.961 | |
| 21 | 4.43E-03 | 8.38E+01 | 8.51E+01 | -1.527 | |
| 22 | 5.64E-03 | 6.87E+01 | 6.99E+01 | -1.631 | |
| 23 | 7.13E-03 | 5.76E+01 | 5.80E+01 | -0.595 | |
| 24 | 8.81E-03 | 4.90E+01 | 4.93E+01 | -0.643 | |
| 25 | 1.10E-02 | 4.09E+01 | 4.20E+01 | -2.553 | |
| 26 | 1.41E-02 | 3.47E+01 | 3.52E+01 | -1.427 | |
| 27 | 1.80E-02 | 2.96E+01 | 3.01E+01 | -1.655 | |
| 28 | 2.22E-02 | 2.64E+01 | 2.64E+01 | -0.244 | |
| 29 | 2.85E-02 | 2.36E+01 | 2.29E+01 | 2.754 | |
| 30 | 3.60E-02 | 2.08E+01 | 2.03E+01 | 2.424 | |

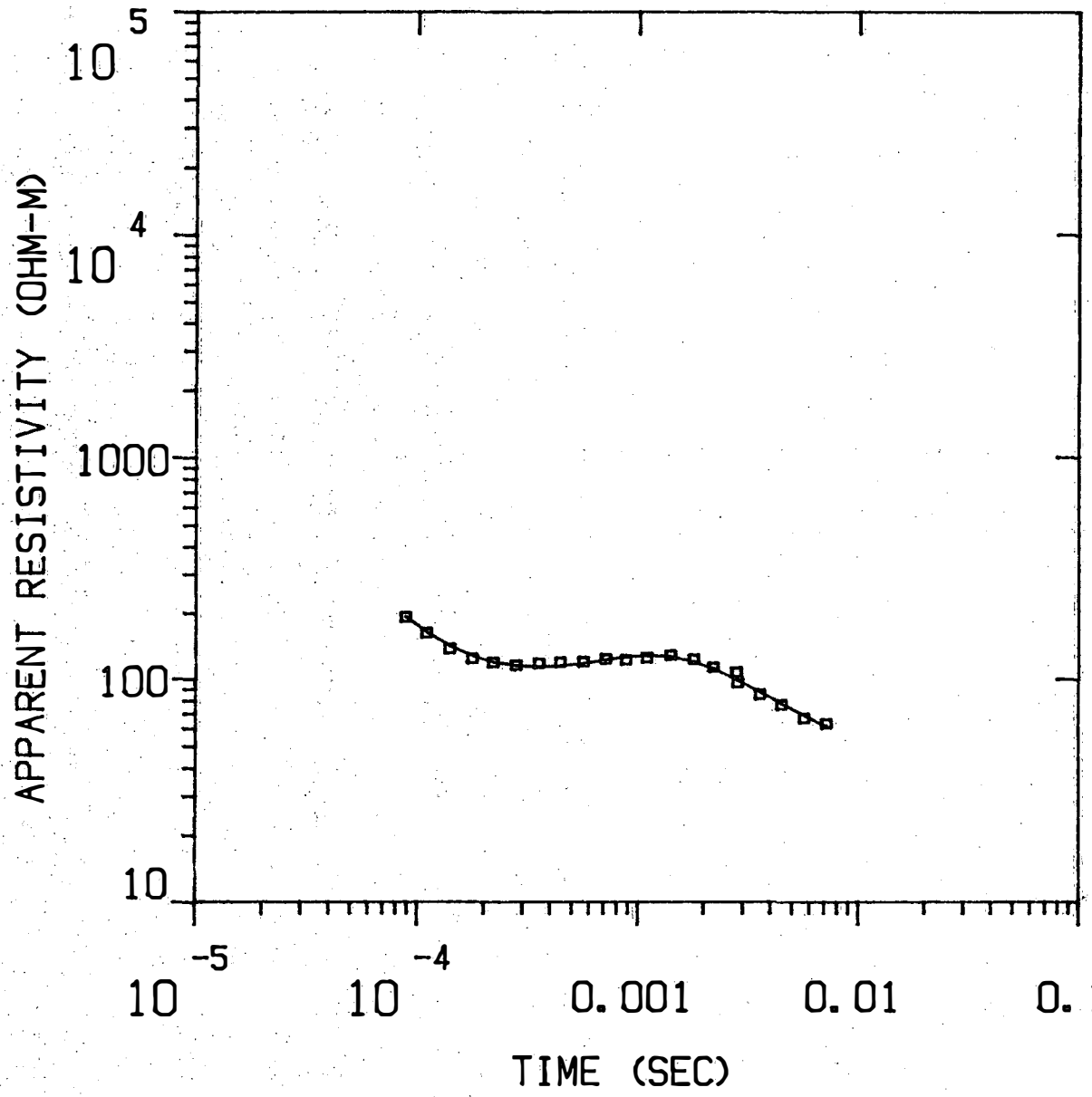
R: 152. X: 0. Y: 152. DL: 305. REQ: 169. CF: 1.0000
TDHZ ARRAY, 30 DATA POINTS, RAMP: 200.0 MICROSEC, DATA: 2N5W
1903 002N 005W Z OPR XTL L 4 10+1000
Ch.21 = 0.2 Ch.22 = 0.89 Ch.23 = 20 Ch.24 = 929
RMS LOG ERROR: 1.24E-02, ANTILOG YIELDS 2.8995 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Inc. *

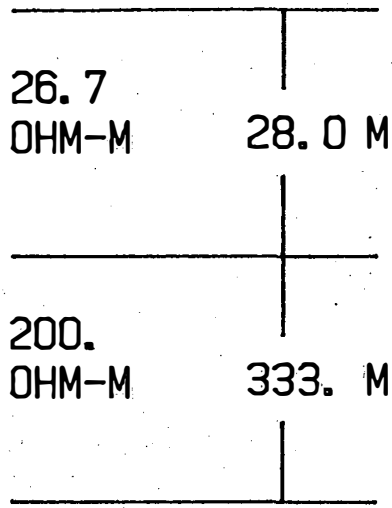
PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER
P 1 0.92
P 2 -0.13 0.22

```
P 3   0.01 -0.03   0.95
T 1  -0.12 -0.27   0.01   0.82
T 2   0.01  0.04   0.00   0.02   1.00
        P 1    P 2    P 3    T 1    T 2
```

# 2N7W




MODEL:




% ERROR: 4.29
CALIBRATION: 1
OFFSET: 152. M
RAMP: 190.0

Blackhawk Geosciences, Inc.

MODEL: 3 LAYERS

| RESISTIVITY (OHM-M) | THICKNESS (M) | ELEVATION (M) | ELEVATION (FEET) | CONDUCTANCE (S) LAYER | CONDUCTANCE (S) TOTAL |
|---|---|---|---|---|---|
| | | 185.9 | 610.0 | | |
| 26.70 | 28.0 | 157.9 | 518.0 | 1.1 | 1.1 |
| 199.84 | 333.4 | -175.5 | -575.9 | 1.7 | 2.7 |
| 17.95 | | | | | |

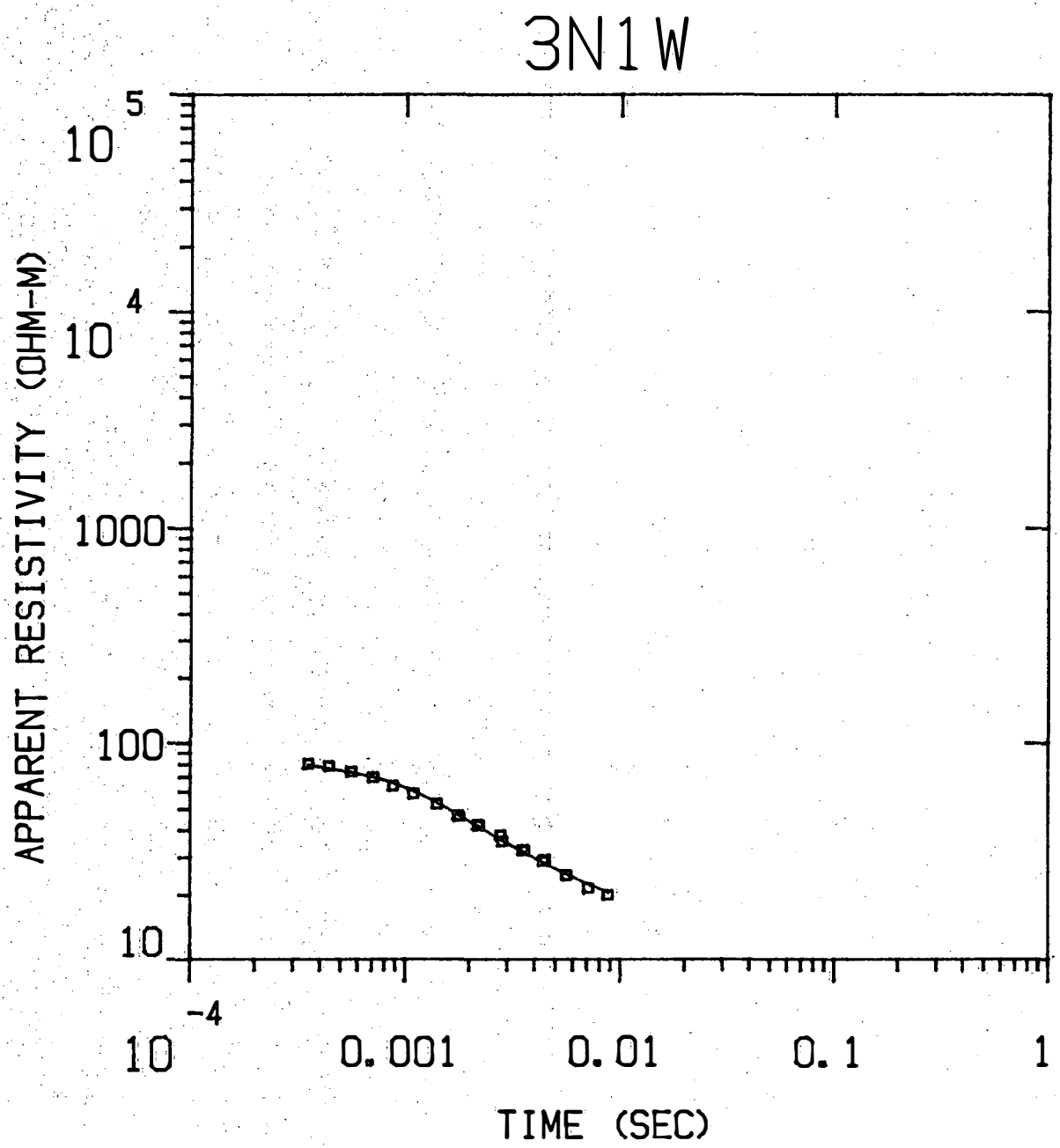
| | TIMES | DATA | CALC | % ERROR | STD ERR |
|---|---|---|---|---|---|
| 1 | 8.90E-05 | 1.91E+02 | 1.93E+02 | -0.784 | |
| 2 | 1.10E-04 | 1.62E+02 | 1.64E+02 | -0.841 | |
| 3 | 1.40E-04 | 1.38E+02 | 1.41E+02 | -2.658 | |
| 4 | 1.77E-04 | 1.24E+02 | 1.27E+02 | -2.799 | |
| 5 | 2.20E-04 | 1.19E+02 | 1.20E+02 | -0.371 | |
| 6 | 2.80E-04 | 1.16E+02 | 1.15E+02 | 0.707 | |
| 7 | 3.55E-04 | 1.18E+02 | 1.13E+02 | 3.851 | |
| 8 | 4.43E-04 | 1.19E+02 | 1.15E+02 | 4.198 | |
| 9 | 5.64E-04 | 1.20E+02 | 1.18E+02 | 1.599 | |
| 10 | 7.13E-04 | 1.23E+02 | 1.22E+02 | 0.851 | |
| 11 | 8.81E-04 | 1.22E+02 | 1.26E+02 | -2.978 | |
| 12 | 1.10E-03 | 1.25E+02 | 1.28E+02 | -2.440 | |
| 13 | 1.41E-03 | 1.28E+02 | 1.26E+02 | 1.468 | |
| 14 | 1.80E-03 | 1.23E+02 | 1.20E+02 | 2.552 | |
| 15 | 2.20E-03 | 1.13E+02 | 1.11E+02 | 1.575 | |
| 16 | 2.80E-03 | 1.07E+02 | 9.94E+01 | 7.675 | |
| 17 | 2.85E-03 | 9.62E+01 | 9.86E+01 | -2.420 | |
| 18 | 3.60E-03 | 8.51E+01 | 8.73E+01 | -2.461 | |
| 19 | 4.49E-03 | 7.66E+01 | 7.76E+01 | -1.364 | |
| 20 | 5.70E-03 | 6.65E+01 | 6.85E+01 | -2.961 | |
| 21 | 7.19E-03 | 6.29E+01 | 6.11E+01 | 3.072 | |

R: 152. X: 0. Y: 152. DL: 305. REQ: 169. CF: 1.0000
TDHZ ARRAY, 21 DATA POINTS, RAMP: 190.0 MICROSEC, DATA: 2N7W
2003 010N 007W Z OPR XTL L 4 10+1000
Ch.21 = 0.19 Ch.22 = 0.89 Ch.23 = 20 Ch.24 = 92
RMS LOG ERROR: 1.83E-02, ANTILOG YIELDS 4.2920 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Inc. *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

| | P 1 | P 2 | P 3 | T 1 | T 2 |
|---|---|---|---|---|---|
| P 1 | 0.87 | | | | |
| P 2 | -0.13 | 0.73 | | | |
| P 3 | -0.01 | -0.07 | 0.86 | | |
| T 1 | -0.21 | -0.27 | -0.03 | 0.63 | |
| T 2 | 0.03 | 0.06 | 0.03 | 0.06 | 0.98 |




MODEL:

33.6
OHM-M

65.3 M

110.
OHM-M

118. M

8.20
OHM-M

% ERROR: 3.78
CALIBRATION: 1
OFFSET: 152. M
RAMP: 190.0

Blackhawk Geosciences, Inc.

MODEL: 3 LAYERS

| RESISTIVITY (OHM-M) | THICKNESS (M) | ELEVATION (M) | (FEET) | CONDUCTANCE (S) LAYER | TOTAL |
|---|---|---|---|---|---|
| | | 170.7 | 560.0 | | |
| 33.60 | 65.3 | 105.4 | 345.7 | 1.9 | 1.9 |
| 109.63 | 118.4 | -13.0 | -42.8 | 1.1 | 3.0 |
| 8.20 | | | | | |

| | TIMES | DATA | CALC | % ERROR | STD ERR |
|---|---|---|---|---|---|
| 1 | 3.55E-04 | 8.01E+01 | 7.93E+01 | 1.003 | |
| 2 | 4.43E-04 | 7.83E+01 | 7.61E+01 | 2.820 | |
| 3 | 5.64E-04 | 7.38E+01 | 7.33E+01 | 0.740 | |
| 4 | 7.13E-04 | 6.95E+01 | 7.00E+01 | -0.761 | |
| 5 | 8.81E-04 | 6.36E+01 | 6.60E+01 | -3.537 | |
| 6 | 1.10E-03 | 5.86E+01 | 6.06E+01 | -3.385 | |
| 7 | 1.41E-03 | 5.28E+01 | 5.36E+01 | -1.512 | |
| 8 | 1.77E-03 | 4.65E+01 | 4.73E+01 | -1.576 | |
| 9 | 1.80E-03 | 4.63E+01 | 4.69E+01 | -1.145 | |
| 10 | 2.20E-03 | 4.22E+01 | 4.17E+01 | 1.217 | |
| 11 | 2.22E-03 | 4.20E+01 | 4.14E+01 | 1.409 | |
| 12 | 2.80E-03 | 3.78E+01 | 3.62E+01 | 4.225 | |
| 13 | 2.85E-03 | 3.55E+01 | 3.59E+01 | -1.172 | |
| 14 | 3.55E-03 | 3.24E+01 | 3.18E+01 | 2.115 | |
| 15 | 3.60E-03 | 3.22E+01 | 3.15E+01 | 2.224 | |
| 16 | 4.43E-03 | 2.88E+01 | 2.82E+01 | 1.911 | |
| 17 | 4.49E-03 | 2.92E+01 | 2.80E+01 | 4.088 | |
| 18 | 5.64E-03 | 2.47E+01 | 2.51E+01 | -1.321 | |
| 19 | 7.13E-03 | 2.15E+01 | 2.25E+01 | -4.363 | |
| 20 | 8.81E-03 | 2.00E+01 | 2.06E+01 | -2.921 | |

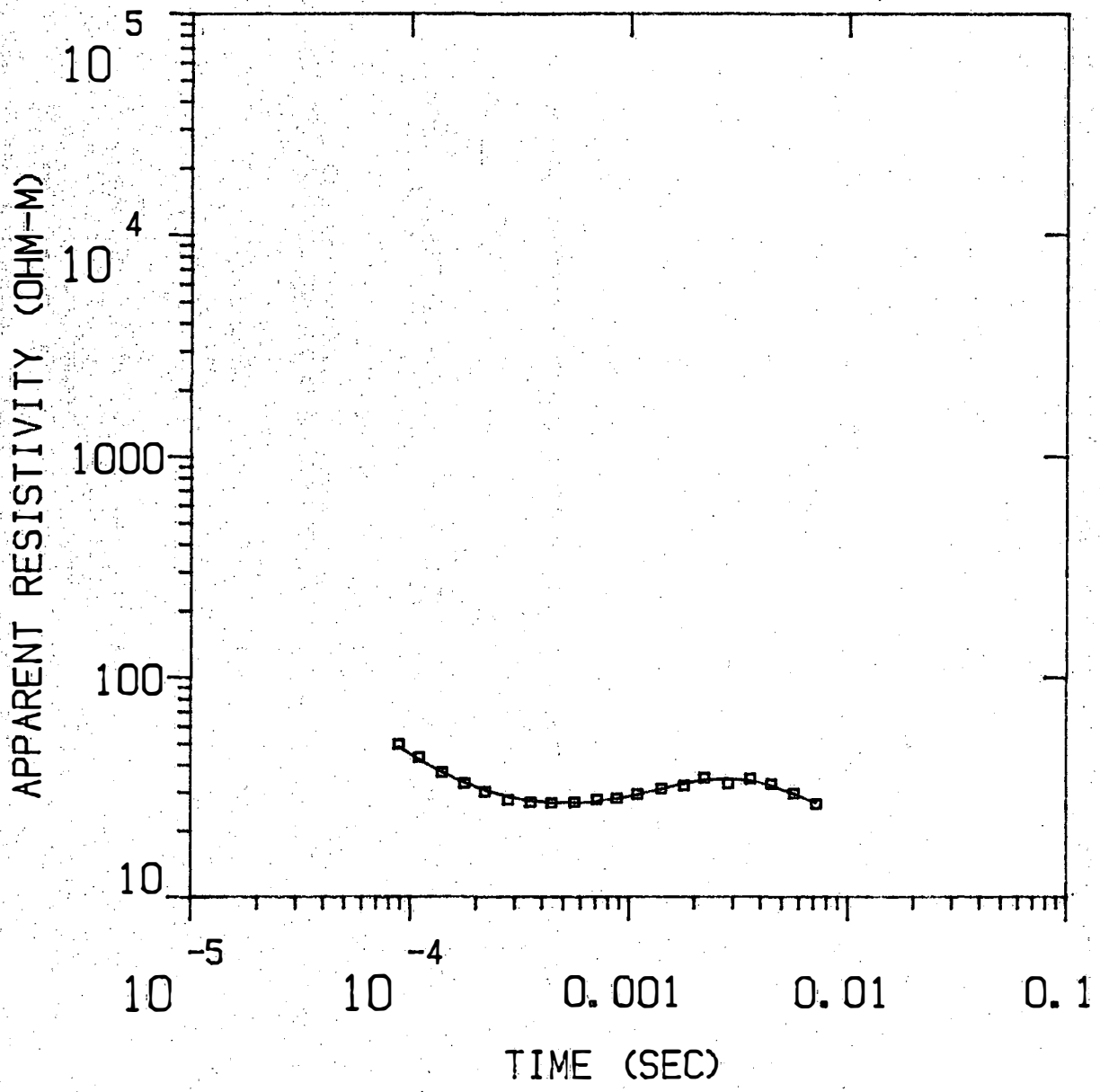
R: 152. X: 0. Y: 152. DL: 305. REQ: 169. CF: 1.0000
TDHZ ARRAY, 20 DATA POINTS, RAMP: 190.0 MICROSEC, DATA: 3N1W
2103 003N 001W Z OPR XTL L 4 10+1000
Ch.21 = 0.19 Ch.22 = 0.89 Ch.23 = 19 Ch.24 = 92
RMS LOG ERROR: 1.61E-02, ANTILOG YIELDS 3.7759 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Inc. *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

| | | | | | |
|---|---|---|---|---|---|
| P 1 | 0.77 | | | | |
| P 2 | 0.12 | 0.03 | | | |
| P 3 | 0.00 | -0.02 | 0.53 | | |
| T 1 | -0.31 | -0.03 | 0.12 | 0.30 | |
| T 2 | 0.15 | 0.09 | 0.12 | 0.26 | 0.78 |
| | P 1 | P 2 | P 3 | T 1 | T 2 |

# WB1W




## MODEL:

20.3
OHM-M

79.6 M

67.7
OHM-M

208. M

7.20
OHM-M

% ERROR: 3.20
CALIBRATION: 1
OFFSET: 61.0 M
RAMP: 100.0

Blackhawk Geosciences, Inc.

WB1W

MODEL: 3 LAYERS

| RESISTIVITY (OHM-M) | THICKNESS (M) | ELEVATION (M) | ELEVATION (FEET) | CONDUCTANCE (S) LAYER | CONDUCTANCE (S) TOTAL |
|---|---|---|---|---|---|
| | | 39.6 | 130.0 | | |
| 20.29 | 79.6 | -40.0 | -131.3 | 3.9 | 3.9 |
| 67.74 | 207.6 | -247.6 | -812.3 | 3.1 | 7.0 |
| 7.20 | | | | | |

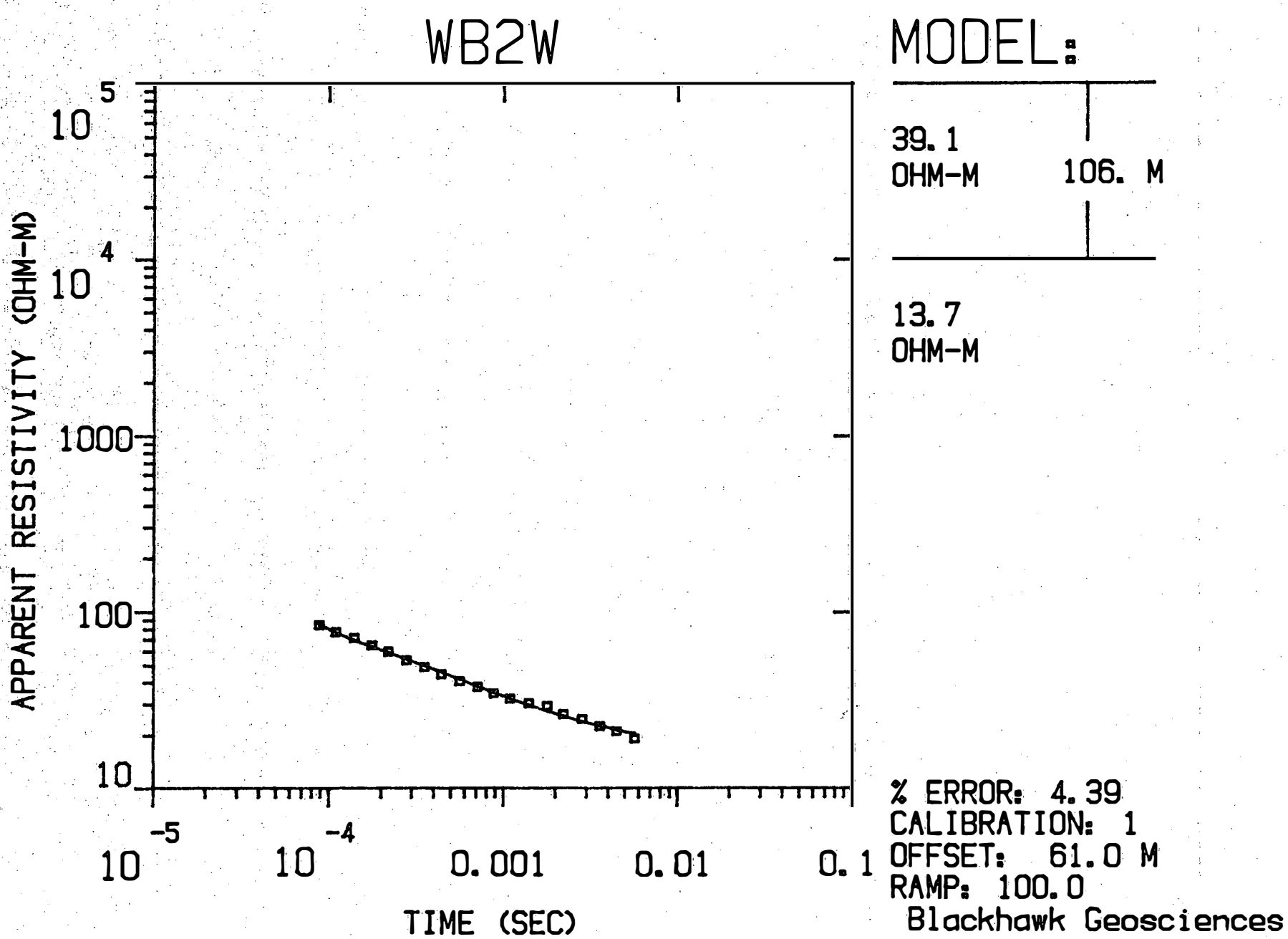
| | TIMES | DATA | CALC | % ERROR | STD ERR |
|---|---|---|---|---|---|
| 1 | 8.90E-05 | 4.97E+01 | 4.83E+01 | 2.853 | |
| 2 | 1.10E-04 | 4.33E+01 | 4.23E+01 | 2.287 | |
| 3 | 1.40E-04 | 3.70E+01 | 3.71E+01 | -0.222 | |
| 4 | 1.77E-04 | 3.29E+01 | 3.33E+01 | -0.925 | |
| 5 | 2.20E-04 | 3.02E+01 | 3.06E+01 | -1.592 | |
| 6 | 2.80E-04 | 2.77E+01 | 2.86E+01 | -3.276 | |
| 7 | 3.55E-04 | 2.70E+01 | 2.74E+01 | -1.244 | |
| 8 | 4.43E-04 | 2.68E+01 | 2.68E+01 | 0.009 | |
| 9 | 5.64E-04 | 2.70E+01 | 2.67E+01 | 1.244 | |
| 10 | 7.13E-04 | 2.79E+01 | 2.72E+01 | 2.599 | |
| 11 | 8.81E-04 | 2.81E+01 | 2.80E+01 | 0.432 | |
| 12 | 1.10E-03 | 2.95E+01 | 2.93E+01 | 0.521 | |
| 13 | 1.41E-03 | 3.13E+01 | 3.11E+01 | 0.374 | |
| 14 | 1.80E-03 | 3.23E+01 | 3.30E+01 | -2.133 | |
| 15 | 2.22E-03 | 3.50E+01 | 3.42E+01 | 2.214 | |
| 16 | 2.85E-03 | 3.29E+01 | 3.47E+01 | -5.179 | |
| 17 | 3.60E-03 | 3.47E+01 | 3.39E+01 | 2.369 | |
| 18 | 4.49E-03 | 3.28E+01 | 3.21E+01 | 2.199 | |
| 19 | 5.70E-03 | 2.97E+01 | 2.96E+01 | 0.215 | |
| 20 | 7.19E-03 | 2.66E+01 | 2.70E+01 | -1.478 | |

R: 61. X: 0. Y: 61. DL: 122. REQ: 68. CF: 1.0000
TDHZ ARRAY, 20 DATA POINTS, RAMP: 100.0 MICROSEC, DATA: WB1W
1503 010N 010W Z OPR XTL H 2 8+100
Ch.21 = 0.11 Ch.22 = 0.089 Ch.23 = 20 Ch.24 = 1
RMS LOG ERROR: 1.37E-02, ANTILOG YIELDS 3.1981 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Inc. *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

| | | | | | |
|---|---|---|---|---|---|
| P 1 | 1.00 | | | | |
| P 2 | 0.00 | 0.97 | | | |
| P 3 | 0.00 | -0.02 | 0.97 | | |
| T 1 | 0.00 | -0.01 | 0.00 | 1.00 | |
| T 2 | 0.00 | 0.01 | 0.01 | 0.00 | 1.00 |
| | P 1 | P 2 | P 3 | T 1 | T 2 |


WB2W
MODEL:
39.1
OHM-M
106. M
13.7
OHM-M
APPARENT RESISTIVITY (OHM-M)
10^5
10^4
1000
100
10
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
% ERROR: 4.39
CALIBRATION: 1
OFFSET: 61.0 M
RAMP: 100.0
Blackhawk Geosciences

WB2W

MODEL: 2 LAYERS

| RESISTIVITY (OHM-M) | THICKNESS (M) | ELEVATION (M) | ELEVATION (FEET) | CONDUCTANCE (S) LAYER | CONDUCTANCE (S) TOTAL |
|---|---|---|---|---|---|
| | | 67.1 | 220.0 | | |
| 39.15 | 105.9 | -38.9 | -127.6 | 2.7 | 2.7 |
| 13.65 | | | | | |

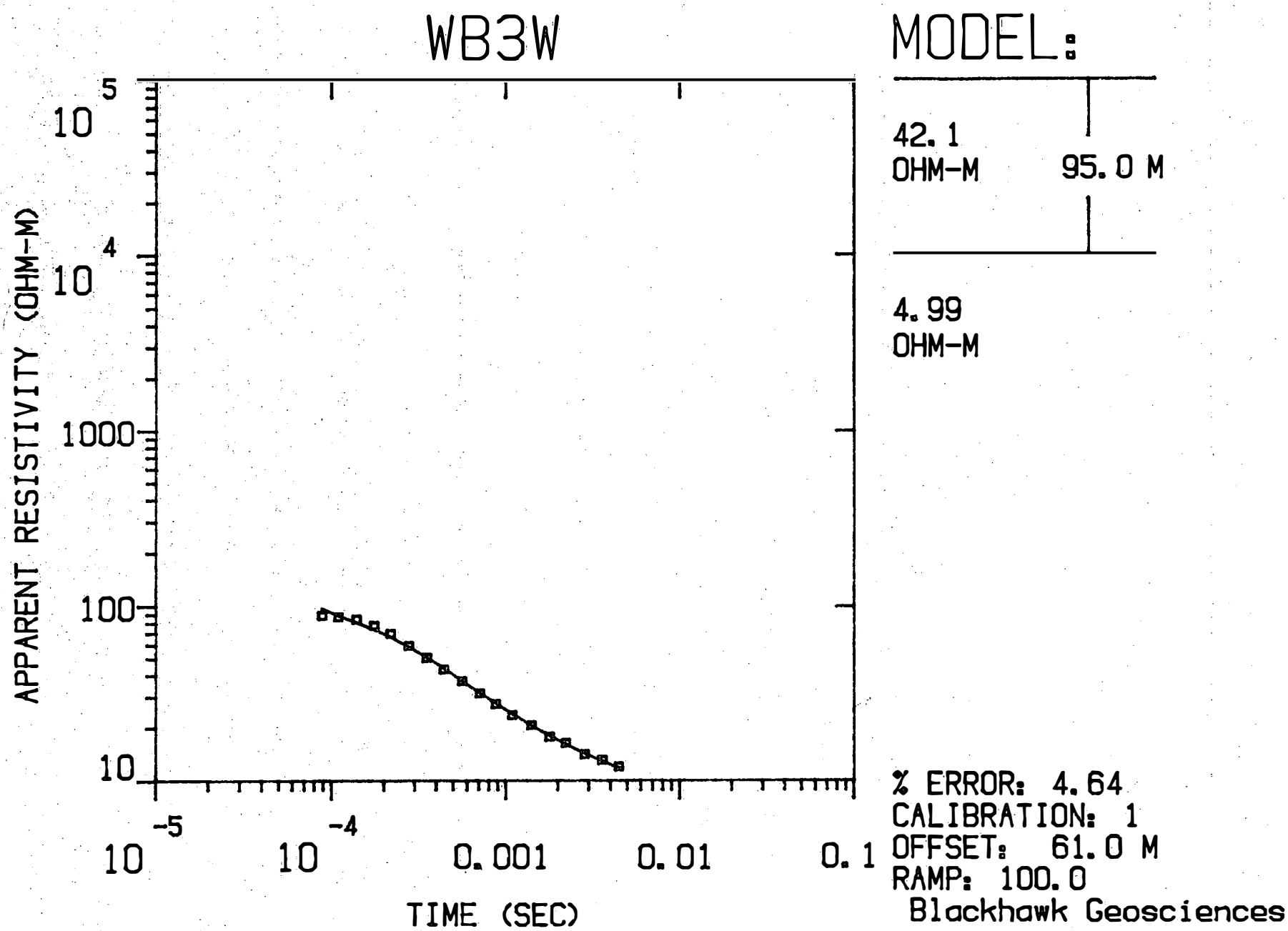
| | TIMES | DATA | CALC | % ERROR | STD ERR |
|---|---|---|---|---|---|
| 1 | 8.90E-05 | 8.45E+01 | 8.50E+01 | -0.572 | |
| 2 | 1.10E-04 | 7.72E+01 | 7.70E+01 | 0.266 | |
| 3 | 1.40E-04 | 7.15E+01 | 6.97E+01 | 2.620 | |
| 4 | 1.77E-04 | 6.48E+01 | 6.39E+01 | 1.451 | |
| 5 | 2.20E-04 | 5.99E+01 | 5.92E+01 | 1.067 | |
| 6 | 2.80E-04 | 5.35E+01 | 5.43E+01 | -1.604 | |
| 7 | 3.55E-04 | 4.91E+01 | 4.99E+01 | -1.720 | |
| 8 | 4.43E-04 | 4.46E+01 | 4.60E+01 | -3.151 | |
| 9 | 5.64E-04 | 4.07E+01 | 4.18E+01 | -2.674 | |
| 10 | 7.13E-04 | 3.78E+01 | 3.81E+01 | -0.793 | |
| 11 | 8.81E-04 | 3.47E+01 | 3.52E+01 | -1.388 | |
| 12 | 1.10E-03 | 3.24E+01 | 3.25E+01 | -0.311 | |
| 13 | 1.41E-03 | 3.05E+01 | 2.96E+01 | 2.875 | |
| 14 | 1.80E-03 | 2.94E+01 | 2.75E+01 | 6.988 | |
| 15 | 2.22E-03 | 2.65E+01 | 2.58E+01 | 2.666 | |
| 16 | 2.85E-03 | 2.48E+01 | 2.39E+01 | 3.545 | |
| 17 | 3.60E-03 | 2.25E+01 | 2.27E+01 | -0.819 | |
| 18 | 4.49E-03 | 2.11E+01 | 2.15E+01 | -1.573 | |
| 19 | 5.70E-03 | 1.92E+01 | 2.05E+01 | -6.398 | |

R: 61. X: 0. Y: 61. DL: 122. REQ: 68. CF: 1.0000
TDHZ ARRAY, 19 DATA POINTS, RAMP: 100.0 MICROSEC, DATA: WB2W
1603 010N 020W Z OPR XTL H 3 8+100
Ch.21 = 0.1 Ch.22 = 0.089 Ch.23 = 21 Ch.24 = 14
RMS LOG ERROR: 1.87E-02, ANTILOG YIELDS 4.3894 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Inc. *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

| | | | |
|---|---|---|---|
| P 1 | 0.96 | | |
| P 2 | -0.02 | 0.71 | |
| T 1 | 0.04 | 0.18 | 0.77 |
| | P 1 | P 2 | T 1 |


WB3W
MODEL:
42.1
OHM-M
95.0 M
4.99
OHM-M
APPARENT RESISTIVITY (OHM-M)
10^5
10^4
1000
100
10
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
% ERROR: 4.64
CALIBRATION: 1
OFFSET: 61.0 M
RAMP: 100.0
Blackhawk Geosciences

MODEL: 2 LAYERS

| RESISTIVITY (OHM-M) | THICKNESS (M) | ELEVATION (M) | (FEET) | CONDUCTANCE (S) LAYER | TOTAL |
|---|---|---|---|---|---|
| | | 67.1 | 220.0 | | |
| 42.14 | 95.0 | -28.0 | -91.8 | 2.3 | 2.3 |
| 4.99 | | | | | |

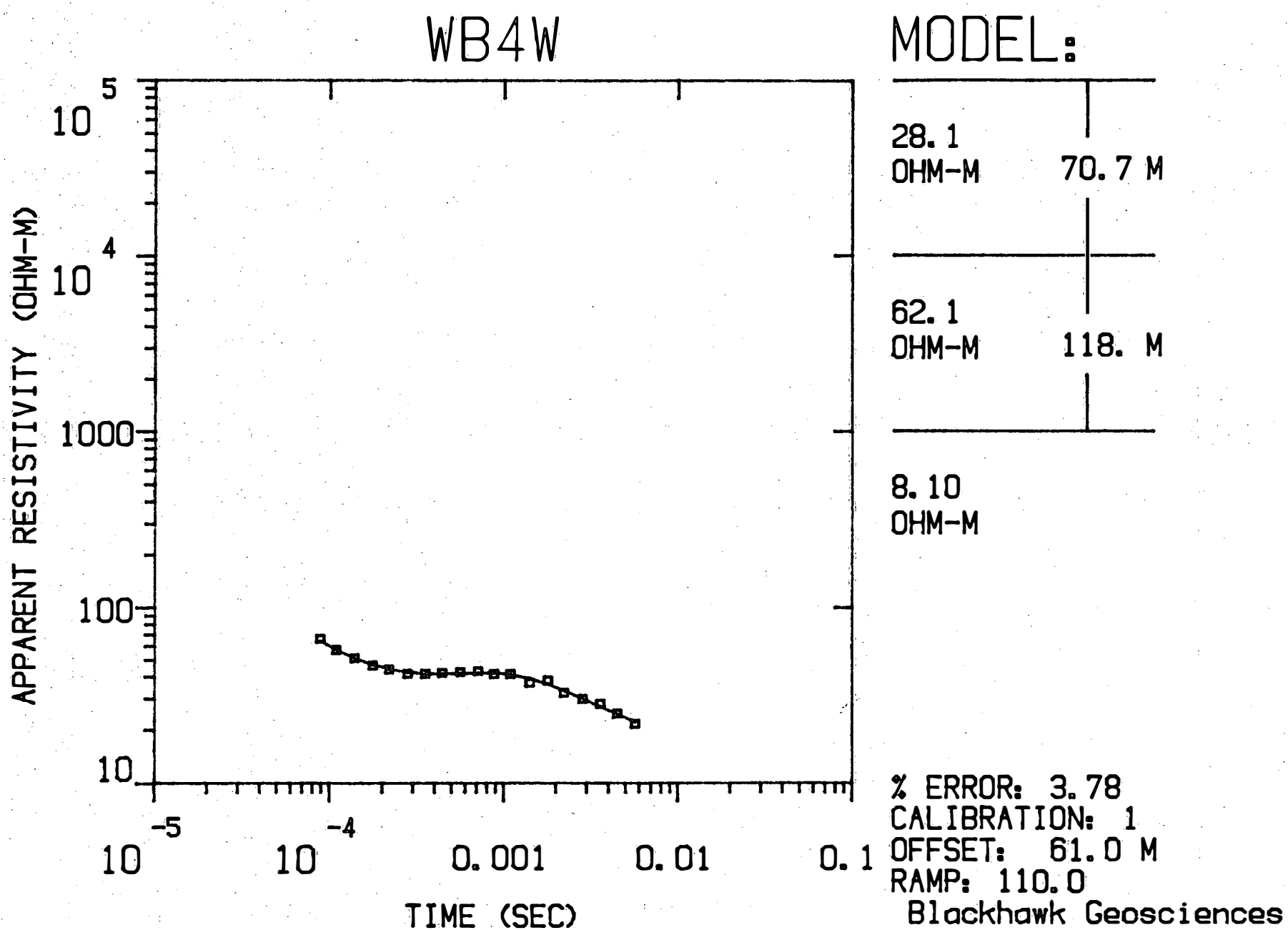
| | TIMES | DATA | CALC | % ERROR | STD ERR |
|---|---|---|---|---|---|
| 1 | 8.90E-05 | 8.86E+01 | 9.67E+01 | -8.362 | |
| 2 | 1.10E-04 | 8.69E+01 | 8.87E+01 | -2.075 | |
| 3 | 1.40E-04 | 8.43E+01 | 8.09E+01 | 4.204 | |
| 4 | 1.77E-04 | 7.75E+01 | 7.38E+01 | 5.007 | |
| 5 | 2.20E-04 | 6.98E+01 | 6.68E+01 | 4.354 | |
| 6 | 2.80E-04 | 5.94E+01 | 5.85E+01 | 1.537 | |
| 7 | 3.55E-04 | 5.06E+01 | 5.08E+01 | -0.442 | |
| 8 | 4.43E-04 | 4.33E+01 | 4.41E+01 | -1.685 | |
| 9 | 5.64E-04 | 3.70E+01 | 3.71E+01 | -0.279 | |
| 10 | 7.13E-04 | 3.15E+01 | 3.17E+01 | -0.665 | |
| 11 | 8.81E-04 | 2.73E+01 | 2.76E+01 | -0.947 | |
| 12 | 1.10E-03 | 2.36E+01 | 2.40E+01 | -1.825 | |
| 13 | 1.41E-03 | 2.06E+01 | 2.05E+01 | 0.493 | |
| 14 | 1.80E-03 | 1.77E+01 | 1.80E+01 | -1.849 | |
| 15 | 2.22E-03 | 1.63E+01 | 1.61E+01 | 1.685 | |
| 16 | 2.85E-03 | 1.41E+01 | 1.43E+01 | -1.250 | |
| 17 | 3.60E-03 | 1.31E+01 | 1.29E+01 | 1.299 | |
| 18 | 4.49E-03 | 1.20E+01 | 1.17E+01 | 2.238 | |

R: 61. X: 0. Y: 61. DL: 122. REQ: 68. CF: 1.0000
TDHZ ARRAY, 18 DATA POINTS, RAMP: 100.0 MICROSEC, DATA: WB3W
1603 010N 030W Z OPR XTL H 3 8+100
Ch.21 = 0.1 Ch.22 = 0.089 Ch.23 = 21 Ch.24 = 14
RMS LOG ERROR: 1.97E-02, ANTILOG YIELDS 4.6396 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Inc. *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

| | | | |
|---|---|---|---|
| P 1 | 1.00 | | |
| P 2 | 0.00 | 1.00 | |
| T 1 | 0.00 | 0.00 | 1.00 |
| | P 1 | P 2 | T 1 |


WB4W
APPARENT RESISTIVITY (OHM-M)
10^5
10^4
1000
100
10
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
MODEL:
28.1
OHM-M
70.7 M
62.1
OHM-M
118. M
8.10
OHM-M
% ERROR: 3.78
CALIBRATION: 1
OFFSET: 61.0 M
RAMP: 110.0
Blackhawk Geosciences

WB4W

MODEL: 3 LAYERS

| RESISTIVITY (OHM-M) | THICKNESS (M) | ELEVATION (M) | ELEVATION (FEET) | CONDUCTANCE (S) LAYER | CONDUCTANCE (S) TOTAL |
|---|---|---|---|---|---|
| | | 48.8 | 160.0 | | |
| 28.12 | 70.7 | -22.0 | -72.1 | 2.5 | 2.5 |
| 62.09 | 117.7 | -139.6 | -458.2 | 1.9 | 4.4 |
| 8.10 | | | | | |

| | TIMES | DATA | CALC | % ERROR | STD ERR |
|---|---|---|---|---|---|
| 1 | 8.90E-05 | 6.60E+01 | 6.43E+01 | 2.708 | |
| 2 | 1.10E-04 | 5.69E+01 | 5.72E+01 | -0.445 | |
| 3 | 1.40E-04 | 5.10E+01 | 5.11E+01 | -0.196 | |
| 4 | 1.77E-04 | 4.64E+01 | 4.69E+01 | -1.045 | |
| 5 | 2.20E-04 | 4.39E+01 | 4.42E+01 | -0.697 | |
| 6 | 2.80E-04 | 4.16E+01 | 4.24E+01 | -1.914 | |
| 7 | 3.55E-04 | 4.16E+01 | 4.15E+01 | 0.114 | |
| 8 | 4.43E-04 | 4.21E+01 | 4.14E+01 | 1.631 | |
| 9 | 5.64E-04 | 4.25E+01 | 4.17E+01 | 1.964 | |
| 10 | 7.13E-04 | 4.30E+01 | 4.20E+01 | 2.327 | |
| 11 | 8.81E-04 | 4.14E+01 | 4.19E+01 | -1.278 | |
| 12 | 1.10E-03 | 4.15E+01 | 4.11E+01 | 0.939 | |
| 13 | 1.41E-03 | 3.69E+01 | 3.90E+01 | -5.509 | |
| 14 | 1.80E-03 | 3.81E+01 | 3.62E+01 | 5.200 | |
| 15 | 2.22E-03 | 3.23E+01 | 3.33E+01 | -2.868 | |
| 16 | 2.85E-03 | 2.99E+01 | 2.99E+01 | -0.140 | |
| 17 | 3.60E-03 | 2.80E+01 | 2.70E+01 | 3.810 | |
| 18 | 4.49E-03 | 2.47E+01 | 2.45E+01 | 0.791 | |
| 19 | 5.70E-03 | 2.16E+01 | 2.22E+01 | -2.834 | |

R: 61. X: 0. Y: 61. DL: 122. REQ: 68. CF: 1.0000
CLHZ ARRAY, 19 DATA POINTS, RAMP: 110.0 MICROSEC, DATA: WB4W

RMS LOG ERROR: 1.61E-02, ANTILOG YIELDS 3.7774 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Inc. *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

| | P 1 | P 2 | P 3 | T 1 | T 2 |
|---|---|---|---|---|---|
| P 1 | 1.00 | | | | |
| P 2 | -0.02 | 0.59 | | | |
| P 3 | 0.00 | -0.07 | 0.90 | | |
| T 1 | -0.02 | -0.28 | -0.02 | 0.76 | |
| T 2 | 0.01 | 0.23 | 0.06 | 0.17 | 0.86 |